JULY 27, 1959

Price 50 cents

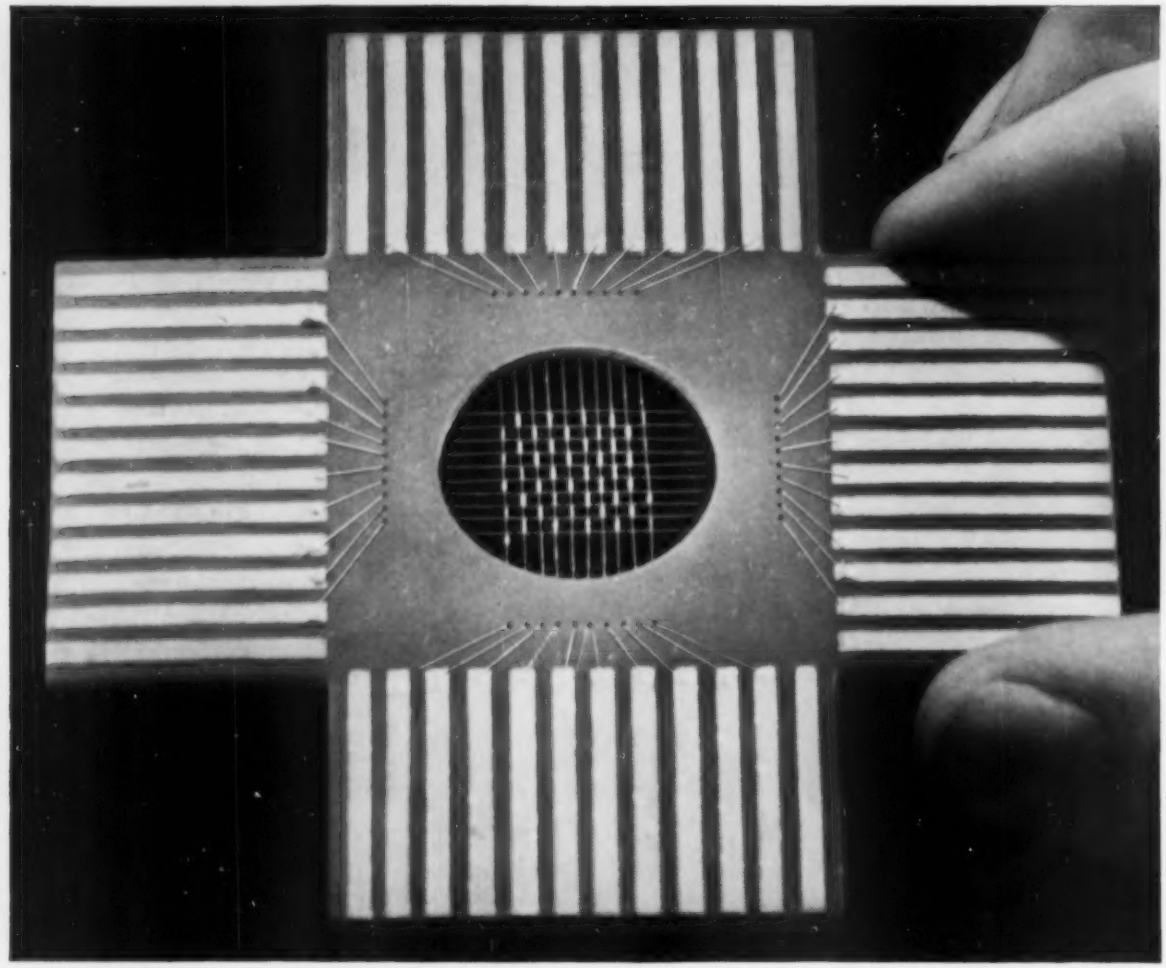
Product Engineering

McGRAW-HILL WEEKLY OF DESIGN, RESEARCH AND DEVELOPMENT

R&D Research and Development news issue

JOB HUNTING— FOR ENGINEERS

see page 32



New twist in memory devices. This simplified model illustrates the basic structure of the "Twistor" magnetic memory. Developed by Bell Telephone Laboratories, the Twistor depends on unique magnetic properties of high-nickel alloy wire.

They twist high-nickel wire to make a machine remember

A new child's toy? Hardly.

This tiny part is an ingenious new kind of magnetic memory. It may well be the heart of the computer of the future.

They call it the "Twistor." It takes advantage of the unusual magnetic behavior of a twisted high-nickel alloy wire.

A group of these wires, interwoven with other wires to form a screen-like grid, can store thousands of "bits" of information magnetically, ready to answer the call of the computer.

The result is a magnetic memory device that costs and weighs less, yet is more compact and rugged than conventional devices.

What makes the Twistor practical is a unique magnetic property found in the high-nickel alloy used for the wire: when twisted, its preferred direction of magnetization shifts from a longitudinal to a helical path. In addition, this alloy permits operation with very low currents so its minute energy requirements are easily supplied by transistor circuits. And, of course, since the alloy is mainly Nickel, corrosion is no problem.

For new twists in design – or in solving metal problems, – Nickel or one of its alloys may offer what you are looking for. If corrosion, wear, high or low temperatures, stresses or fatigue are factors, let's get together to talk it over.

The International Nickel Company, Inc.
67 Wall Street New York 5, N.Y.

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YOUR INDEX IS READY

A 20-page printed index of all editorial content in issues of the first six months of 1959 (Vol 30-1) is now ready. Copies may be obtained by writing "Index Vol 30" in the space marked "Special Data" on the Reader Service Card facing the inside back cover.

This Index Includes

- **a subject-classified breakdown of all editorial content**
- **an alphabetical index of authors**
- **an index of company names mentioned in connection with important news or developments**

The index is issued twice each year in July and January, and single copies will be sent free on request as long as the supply lasts. A limited supply of the index for 1958 (Vol 29-1 and Vol 29-2) is still available.

coming next week

the DESIGN issue

for August 3

FEATURING

- **Dry-friction damped isolators**
  Can outperform viscous types. Here are curves and equations to predict operation.

- **Transistors—the 6 basic types**
  Methods of construction and how they influence performance.

- **When you have to flameproof a product**
  What does flameproof mean? How can design best meet the demands for fire safety?

- **Big change in rubber-to-metal bonding**
  Aided by new adhesives, this technique will join almost any metal to nearly any rubber.

- **15 ideas for cam mechanisms**
  An assortment of devices shows the many ways cams can be put to work.

- **3 nomographs for gear-force analysis**
  Quick answers for spur and helical gears.

Product Engineering

McGRAW-HILL WEEKLY OF DESIGN, RESEARCH AND DEVELOPMENT

R and D research and development news issue

July 27, 1959 Vol. 30 No. 30

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Product Engineering ..... SIDELIGHTS

R and D RESEARCH and DEVELOPMENT news issue

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● **How to get a good engineering job** (p 32) has a corollary problem of how to improve it once you've got it. Boeing Airplane Co engineers, in a new contract with the company, seem to be going all out for status. The company has agreed to supply its professional engineers with badges different in color from those issued to non-engineers. Further, a line will be added to drawing title blocks to provide space for the engineer's signature in addition to that of draftsman and checker.

● **Kettering never thought much of committees** (p 36). Someone once remarked in his presence that Lindbergh's flight to Paris was a modern miracle. "He was alone," said Kettering, "that makes it an accomplishment, not a miracle. Now if it had been done by a committee, *that* would be a miracle."

● **Computer designers have been very revealing** in the names chosen for their brain children. It all began with Charles Babbage and his Difference Engine—an obviously 19th-century name. Much later Harvard's dignified Mark I came along. But it took the ENIAC and the EDVAC to start the trend to such beauties as SEAC, DYSEAC, UNIVAC and ILLIAC. Only IBM, with its insistence on numerical identification, resisted, but when BARC, LARK and TRICE were produced IBM started STRETCH and the floodgates opened. You can now buy a MANIAC, IDIOT or even DAFT. Take these names literally if you like, but we think the designers are getting scared. The names suggest some wishful thinking . . .

July 27, 1959

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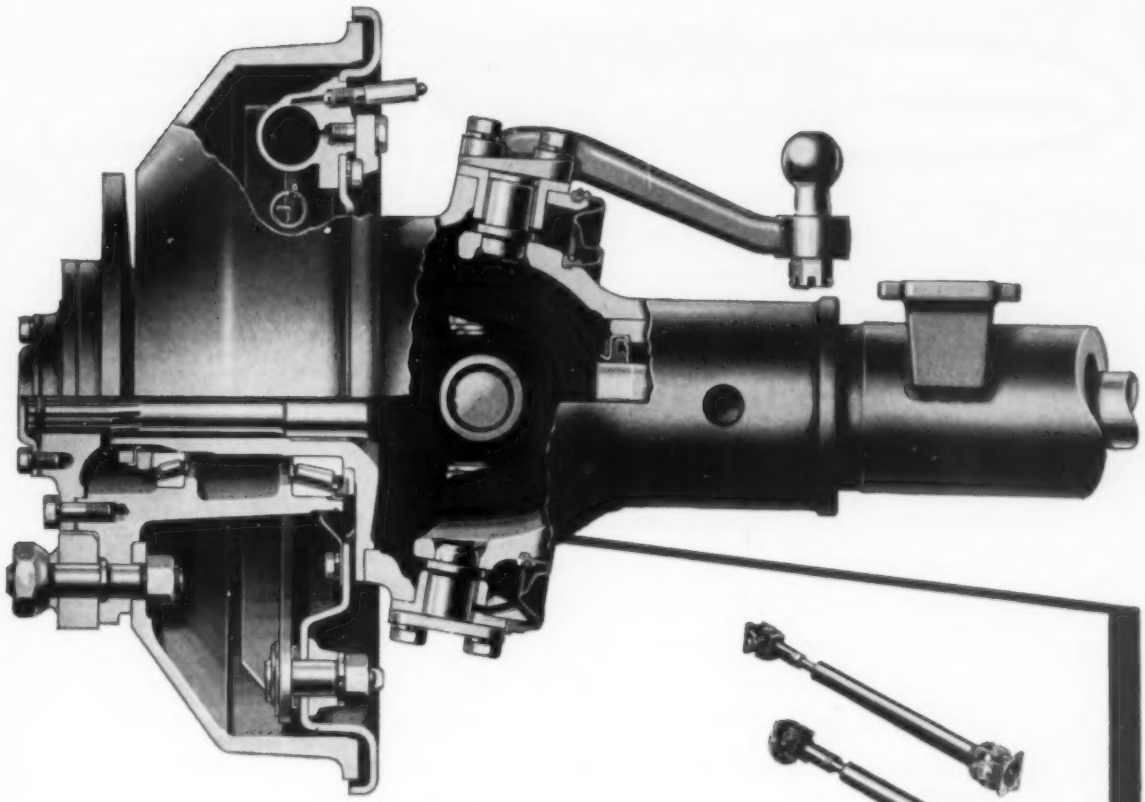

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When this major axle source wanted an improved front-driving unit for a truck-building customer, their engineers and ours got together. The result shown above now provides users of famous brand trucks with *substantially increased capacity* on their front-driving axles.

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UNIVERSAL JOINTS AND DRIVE LINE ASSEMBLIES

Reader To Editor...

English Forgings

To the Editor:

We are somewhat intrigued by the note on upset forgings for axle shafts which appears on p 43 of the June 8 issue. It would appear there is still a very large proportion of industrial America not yet conversant with the process known as electrical upsetting and pioneered over a quarter of a century ago by my company, which has, incidentally, also supplied special-purpose equipment in the US and Canada.

Omes regularly supplies, from its Works in England, a very impressive tonnage of upset axle shafts, half shafts, etc., for the British automobile industry. Other applications and upsets of widely varying shapes are forged from stock as great as 40 times the cross-sectional area of the bar, all forgeable in one heat, the total heating and upsetting occupying a matter of seconds. —V A Butler

Chief Development Engineer
Omes, Ltd, London, Eng

To the Editor:

On page 43 of your June 8 issue there is a report that Commercial Shearing and Stamping Co is trying to upset more than 3 diameter of rod stock in a single pass. I did this in 1924 on an Ajax machine. I am now 70, retired and have no axes to grind. Thought you'd be interested.

—Clayton H Frost

Atlantic Highlands, NJ

Britisher Views US Railroads

To the Editor:

As a Britisher, who is very friendly disposed towards the American people, I have read with keen interest your May 18 issue, in which you comment (p 21) on European locomotive and train designs. You are certainly right when you say that your country is left behind today. Permit me to make a few well and sincerely meant suggestions:

1) Administrative reform of the US railroads, to eliminate the influence in engineering matters of bankers, lawyers, politicians and the oil and auto industry.

2) A complete study of the diesel locomotive's role in the alarming financial situation of the US railroads.

3) Large-scale electrification (60 cycle ac after the French technique) of all US trunk lines with complete disregard of the role of diesel power.

4) Revival of branch line service, with electric storage battery-powered railcars, as used in Scotland and Germany.

5) Upgrade the men who specialize in railroad engineering, so that they are equal in status with lawyers and operating personnel. Where government subsidies are needed to continue operation, all policy-making functions to be in the hands of professional engineers.

6) An invitation to European rail experts, to recommend to the US carriers administrative changes to make the research departments as efficient as their European counterparts.

It is my earnest hope that American engineers will become more interested in their own rail problems, instead of trying to sell American railway practices abroad. Give-away plans, to flood the world with US diesels, at taxpayers' expense, disrupts our own locomotive manufacturing business, which we don't like.

—W Wakefield Adam

E Twickenham, Eng

Science with a Purpose

To the Editor:

Congratulations for your very clear and realistic editorial which appeared in the June 22 issue, p 62. As a graduate engineer employed in an R & D capacity, I can agree completely with the sense and timeliness of your article. Before this R & D position, I was a sales engineer to the various missile concerns, and there especially I encountered the attitude of "I am a scientist" on the part of nearly every engineer, draftsman, and purchasing agent.

Certainly, I would be one of the first to defend the need for pure science and its attendant research (I also hold a degree in Nuclear Physics), but the sane, experienced, practical approach of the engineer to a problem or to the results of the scientists' research is a very necessary cog in the complex machinery of this present age. I especially appreciated one of your ideas, ". . . engineering which is science with a sense of purpose." That, I believe, contains the essence of your editorial.

It is indeed refreshing to read such logical reasoning as yours in a time when moon-madness and space-happiness seem to have a strong grip on so many of our fine minds. —John M Snuggs

Senior Mechanical Engineer
International Electronics Mfg Co.
Washington, DC

Electrostatic Air Cleaner

To the Editor:

A paragraph in your June 29 issue, p 42, has been called to my attention. This was a request by Mr R Blagden for a cleaning device that could be installed in windows to keep out dust and dirt from homes. We would appreciate your informing Mr Blagden that we manufacture Lectrofilter, which is an electrostatic air cleaning device which uses the van de Graff principle to generate a high-voltage electrostatic charge transmitted to a filter. Every fiber of the filter becomes charged and gives effective air cleaning for minute particles of dust, pollen and dirt which would pass through this filter as in other ordinary filters if it were not charged. —R C Marbach

Coolerator Div, McGraw-Edison Co
Albion, Mich

ANNOUNCING . . .

The Birth of a New Era in Small Air Control Valves

by: WILLIAM CARLS, President, Numatics, Inc.

The last five years have seen air controls expand into countless operations where automation was once considered impossible or uneconomical. Most of these operations involve cylinders of 3¼" bore or smaller.

In these applications both the physical size and the cost of the valve are vitally important, and the wasteful practice of over-valving, using a valve of considerably greater capacity than needed, cannot be tolerated. So, more and more, these systems are being *engineered* rather than being just built.

Engineers, however, have been handicapped by the lack of well-engineered *small* valves. Up to now, small valves have gained smallness by sacrificing adequate wiring space, sub-plate and manifold mountings, manual operators, and compliance with JIC Standards. In many cases the all-important double solenoid momentary contact action simply was not available. And too often basic valving action was not heavy duty and wouldn't stand up under multi-million cycle demands.

Two years ago Numatics started development of a family of small 4-way valves for this field. Objective: to produce a well-integrated group of compact valves which would offer the heavy duty ruggedness of our famous patented lapped spool-floating sleeve action in a variety of housings, mountings, and options to cover the entire field, from a basic valve at a rock-bottom price, to a manifold assembly with all the features required by JIC Standards.

The result of two years of intense work is our new "SA JUNIOR" Series . . . a ¼" valve with capacity to operate a 3¼" bore cylinder at a piston speed of one foot per second, capable of doing about 60% of all valving jobs in the average plant, yet so small physically, and so modestly priced that it might well cut your air valve costs by 40%!

Our new catalog SAJ-59 tells the complete story of SA JUNIOR and a copy is yours for the asking. Just send the coupon below.

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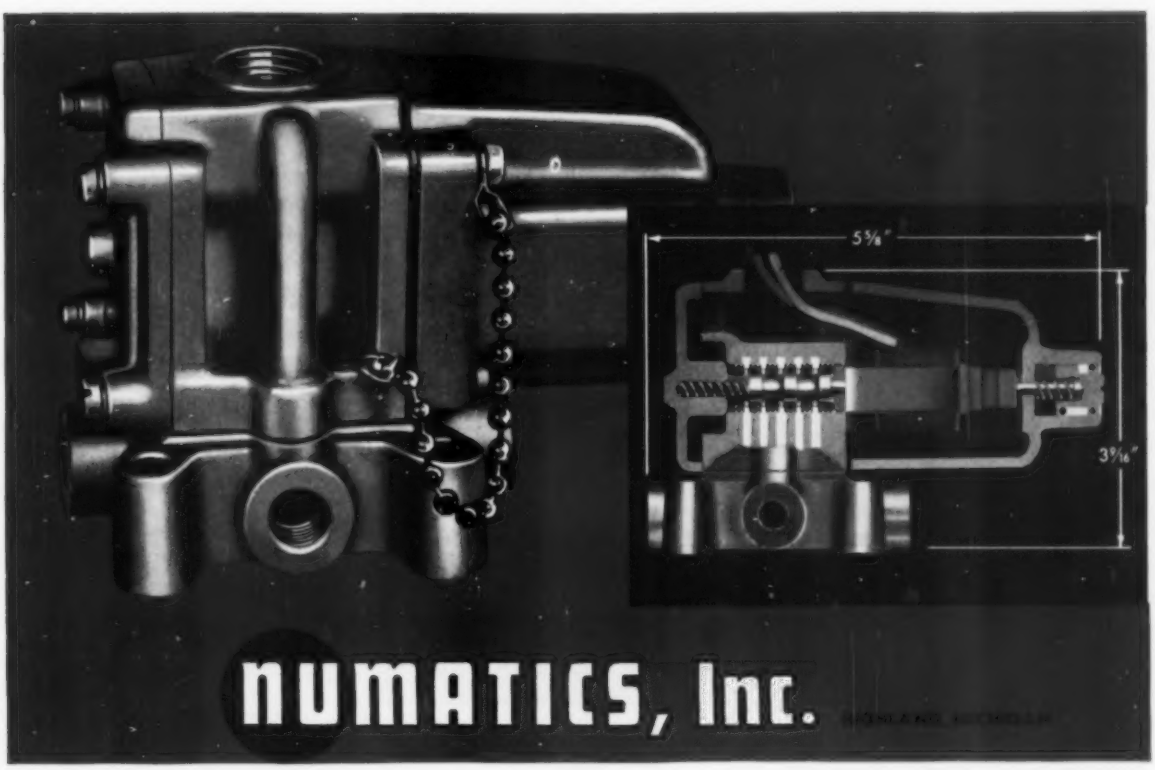
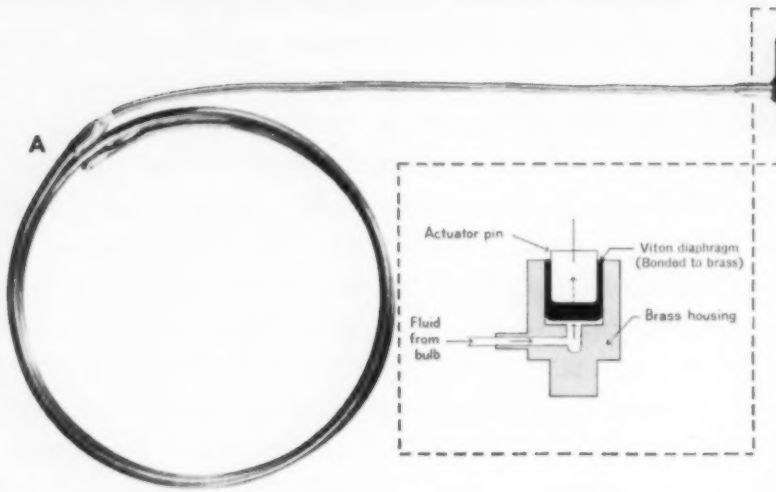


This improved thermostat couldn't work without **VITON**®



Actual size of thermostat

HOW IT WORKS—Heat-expansible fluid inside the bulb (**A**) expands through copper tube to thermostat (**B**). Fluid exerts pressure against VITON diaphragm inside thermostat. Diaphragm pushes against a metal actuator pin which trips electrical contact or control valve. VITON synthetic rubber provided the necessary fluid and heat resistance that made this design practical.

Instrument designers have long recognized the advantages of using a thermostat with an elastomeric diaphragm for electric and gas ranges as well as other appliances. Such a thermostat could be made smaller than bimetallic or metal diaphragm types, would be much more sensitive to temperature changes, operate more quickly—and cost less.

But, until recently, no elastomer was available that would hold up in service. Those tested swelled in contact with the heat-expansible fluid used in the thermostat or they were unable to stand the high operating temperatures. Either the heat or fluid always destroyed the thermostat's accuracy . . . if not the synthetic rubber diaphragm itself.

New DuPont VITON synthetic rubber has solved both these problems. VITON easily withstands the required temperatures (from 300° F. to 400° F.). It has good adhesion to brass—essential to the proper functioning of the diaphragm. The bulb fluid does not attack the VITON—even at 400° F. temperatures—nor does it permeate the rubber diaphragm.

As a result, a completely practical elastomeric thermostat is now available. Its bulb volume is roughly ⅛ that of diaphragm-type thermostats previously used. It operates quicker and with greater sensitivity to temperature changes than other types . . . and can be fabricated at much lower total materials cost.

Wherever *you* need an elastic material that can stand high temperatures (450° F. and up), oils, solvents, chemicals . . . and offer outstanding mechanical properties as well . . . consider VITON. For more information about this new synthetic rubber, write to E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. PE-7, Wilmington 98, Delaware.

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SYNTHETIC RUBBER

NEOPRENE
HYPALON®
VITON®
ADIPRENE®

Better Things for Better Living . . . *through Chemistry*

DEVELOPMENTS TO WATCH...

American

New ceramics, featuring abrasion and erosion resistance . . .

. . . as well as ability to withstand high temperatures are in development at Denver Fire Clay Co. Already in pilot production of crucibles and special shapes in high-purity magnesia, zirconia, alumina, and silica, Denver Fire Clay's Research Lab is now concentrating on materials that can be formed in place (for use in chemical and petroleum reactors, for instance).

Attitude-control systems with response times of 1 to 3 millisec . . .

. . . as compared to present space-craft systems which have approximately a 200-millisec response time, are on the way. Sundstrand Turbo, Pacoima, Calif, is working on both solid- and liquid-propellant gas generators to power reaction steering jets. Major problems right now are in metering and burning "an eyedropper of fuel, a drop at a time, with clean start and stop"; but Sundstrand believes these problems can be solved—and hopes the job can be done in less than a year's time.

Best gear materials for service to 700 F . . .

. . . are a high-speed tool steel with relatively low alloy content (a modified M50) and a hot work die steel of the H-12 type. That's the conclusion of General Electric engineers after testing a dozen materials being considered for high-temperature service (among the others: M1 high-speed tool steel, Nitralloy N, cobalt-chrome die steel, and a titanium alloy).

The test showed, though, that choice of materials depends a great deal on lubricant used and should also be based on a determination of whether the primary problem in each case is fatigue failure or scoring.

M50 steel, modified to drop the carbon level below 0.2% and add nickel as a ferrite inhibitor, was the best from the fatigue standpoint.

A modified H-12 with a high core tensile strength had the best scoring resistance when silicone oils were used; but M1 highspeed tool steel outperformed it with mineral oils.

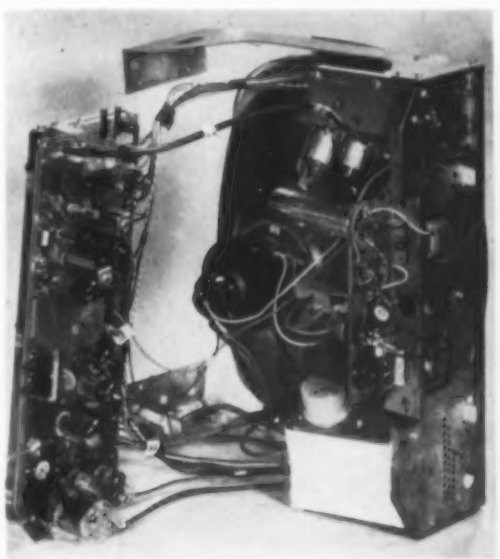
A complete report on the study, prepared for Wright Air Development Center, is to be made available through OTS, Dept of Commerce, Washington 25, D. C. It has been given the number 151,625, is about 80 pages, and is priced at $2.25.

Improved plated circuit design, to minimize service problems . . .

. . . has been developed by Motorola, Inc, will be introduced on a limited basis in 1960 portable TV models.

The new circuit is color-coded in accordance with RETMA specifications; and, on each side, the outline of the circuit on the other side is printed in black so there is no need to turn the board over to follow conductor lines. A number of features have been provided to facilitate board removal. All connections are made by 4 simple clips and 3 specially designed connectors which carry 12 contacts each. There is also a spring-loaded lever device to eject the board. Furthermore, loosening 4 screws makes it possible to slide the chassis assembly completely free of the set.

Other features claimed for the new board: unusual rigidity; a peel strength more than twice that of previous boards, and much thicker plating.—ARG



New circuit assembly quickly slides free of set. Note extra-long leads that make disassembly for servicing possible without disconnecting.

DEVELOPMENTS TO WATCH...

Washington

Radiation protection afforded . . .

by conventional-type houses is now being studied by AEC. Tests will be conducted at its Oak Ridge, Tenn, facility using a half-dozen houses. Measurements will include degree of protection given at different locations within the house, plus effect of terrain, foilage, basements and nearby structures.

Results of the tests "may have broad civil defense implications," the AEC says. One outgrowth may be development of mobile test vehicles to make radiation-shielding measurements on individual homes so homeowners will know where to get maximum protection in case of a nuclear blast.

Defense contractors . . .

must still face contract renegotiations, but losses on defense business can now be carried forward five years instead of two.

This is about the only change Congress wrote into the Renegotiation Act when it recently extended the measure for another three years. Under the act, the government can recapture "excessive" profits.

Contractors wanted more changes in the law—such things as easier appeals rules, and exemption for contracts that contain incentive clauses.

While industry's pleas were turned down, Congress authorized a full-scale inquiry into operations of the act. Industry representatives hope this will serve as basis for revising the law next year.

Contracts for a sea water conversion plant . . .

are expected to be let before next June. The Office of Saline Water, moving at a faster pace than originally anticipated, has asked Congress for an additional $1.5 million this year for the first plant.

Site location is expected to be made soon—it will be somewhere along the Gulf coast. The second demonstration plant will be built on the California coast, but not before 1961.

The first two pilot plants will use a distillation process for the conversion of sea water. A third plant is planned that will use an electrodialysis process to convert brackish water.

High-energy fuel program . . .

of the military is under scrutiny. Speculation is that a new multi-million dollar plant may be shut down, virtually before it goes into production.

The military have two big plants just starting initial production of boron base fuels. These "exotic" high-energy fuels (*PE*—Sep 9, '57, *p* 25) will be for such planes as the B-70 bomber and the F-108 interceptor now being developed by North American Aviation.

Olin Mathieson operates one of the plants for the Air Force at Niagara Falls. It cost $40-45 million to build. Callery Chemical Co operates the other plant for the Navy at Muskogee, Okla. It cost $38-40 million.

Back a few years ago, widespread use of these fuels was expected—because of the extra range they could give manned aircraft. Now, however, it seems Navy has no need for the fuel, because of technological advances, program, changes, etc. But it has a new plant on its hands and it is doubtful the Air Force needs two plants.

Result is Pentagon has ordered a 60-day study by the Arthur D Little Co to determine which of the two plants should be kept going if the final decision is made to shut one down.

Navy says it will operate its Muskogee plant until end of the year, but wants it off its hands by then. The plants, just going onstream, will take almost a year before they normally would hit peak production of 5 tons a day of the HEF-3 fuel.

Mechanical engineers . . .

received more than $667 thousand in research grants from the National Science Foundation during fiscal 1959 (year ending June 30, 1959). The 22 individual grants ranged from $5,700 to $100,000, called for study ranging from one to five years and went to professors in 16 universities and engineering schools. MIT received the largest number of grants—six—Johns Hopkins, the largest single grant—$100,000 for a five year study of isotropic turbulence. Most grants run for two or three years.

CIRCLE NO. 11 READER SERVICE CARD →

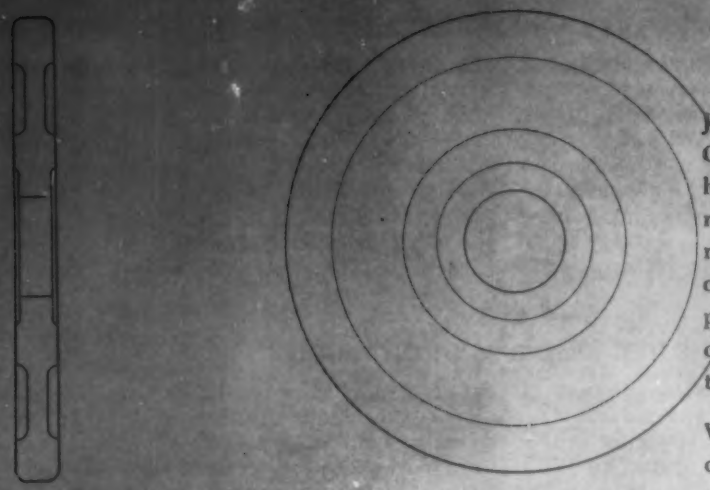
A NEW HIGH

IN METALLURGICAL PROPERTIES FROM EXOTIC METALS

Jet engine components made from Cameron forgings have hit a new high in forming and in metallurgical refinements, developing not only room temperature properties 20% over specifications but, more importantly, producing these same over-specification values at elevated temperatures.

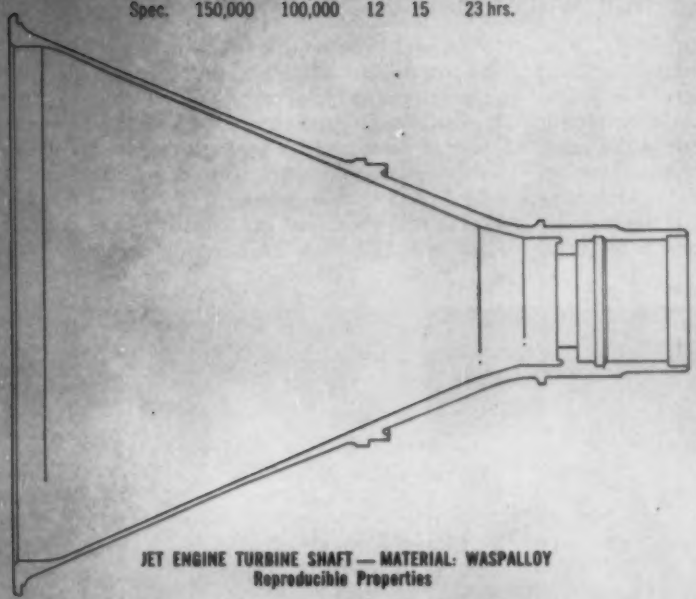
With our special forging techniques, one heat and one push produce uniform properties from surface to center, and from hub end to flange end. Even in high density alloys, interesting economy is effected. Favorable billet to finished forging weight ratio means less of the expensive material is used in each operation. Because of improved grain structure and close controls throughout the entire process, machining qualities are excellent.

All this, of course, gives our customers a better component functionally and economically. Check the accompanying comparison of the specification values and obtained values on the two jet turbine rotating components shown—let us show you what we can do with your problem forgings—just CALL, WRITE, or COME BY



JET ENGINE TURBINE DISC — MATERIAL: INCO 901

	T.S.	Y.S. .2%	E.L.	R.A.	S.R. 1200° F. 80,000 lb./sq. in.
	175,000	128,000	20	23	225 hrs.
Spec.	150,000	100,000	12	15	23 hrs.



JET ENGINE TURBINE SHAFT — MATERIAL: WASPALLOY
Reproducible Properties

	T.S.	Y.S. .02%	E.L.	R.A.	S.R. 1350° F. 70,000 lb./sq. in.
	196,200	131,700	23	32	71 hrs.
Spec.	160,000	90,000	15	18	23 hrs.

Cameron

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SPECIAL PRODUCTS DEPARTMENT
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DEVELOPMENTS TO WATCH...

World-wide

A low-cost, pulse-monitoring oscilloscope . . .

. . . featuring an "exceptionally fast rise time" (2 milli-microsec), high sensitivity, and portability, is being introduced by Mullard Equipment Ltd, London, Eng. It's a transistorized unit, based on a design originally developed by the United Kingdom Atomic Energy Authority, and it can display identically shaped pulses of random separation such as those occurring with nuclear detectors. It is also expected to be useful in computer and radar studies.

The trace is built up as a low-frequency replica of the input by means of a series of dots, each of which corresponds to a sample taken from successive repetitions of the input. A charge storage circuit maintains the position of a dot until the succeeding sample is taken so that, Mullard claims, the beam is "on" for about 80% of the cycle time, and "a display of high brilliance is obtained."

The unit is 15 by 9 by 19 in., weighs 27 lb.

A measuring instrument that displays information . . .

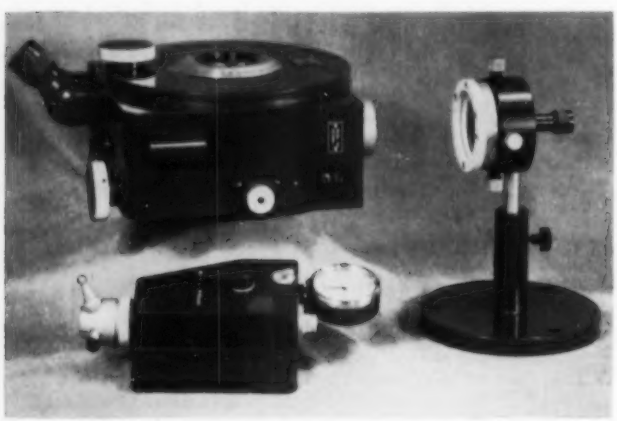
. . . from multiple locations as a standing picture on a TV screen and makes it possible to manipulate beams from individual test spots as desired has been developed at Institut Dr Foerster, Reutlingen, W Germany. Test results—measurements taken at several locations on a shaft, for instance—are displayed as beams of varying length, showing positive or negative deviations from a preselected norm. Furthermore, says the institute, since the sensitivity of each measuring spot is adjustable, the instrument can be set so that upper and lower limits for all test points appear at equal heights on the screen. It is possible, too, to superpose the profile of the test object itself by means of a mask to permit direct readings.

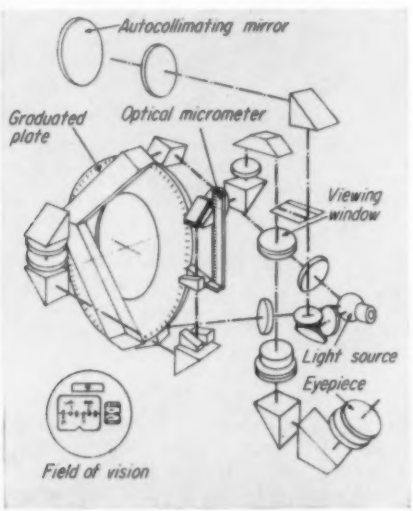
An angle division tester that will inspect . . .

. . . mechanical dividing heads, rotary stages, gear wheels, and star wheels has been developed by VEB Carl Zeiss of Jena, East Ger. Features of the design (see diagram) are a graduated glass circle, connected to a takeup bushing, plus a rough scale in the outer wall of the instrument casing, an auto-collimating telescope which can be aligned with the separate mirror, a sighting device (also attached to the outside of the casing), and an auxiliary telescope to facilitate adjustment. To eliminate errors that might be caused by eccentricities in the graduated circle, readings are made from two locations.

Dual images of the graduated scale appear in the field of vision and are made to coincide by means of an optical micrometer. The angle is then read off the base and vernier scales.

For star wheels and gear wheels, a swing-out ball stop with a precision indicator is furnished. —ARG

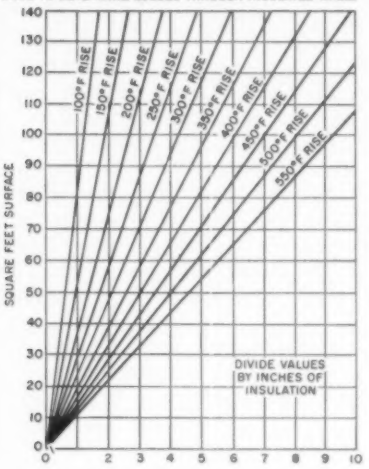




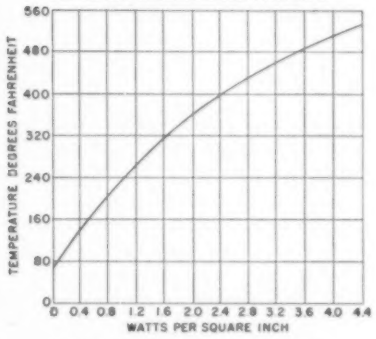
East German measuring device is pictured and diagrammed here. Photo shows main unit, separate mirror, and auxiliary telescope.

How to choose the right amount of heat for ovens and process air applications

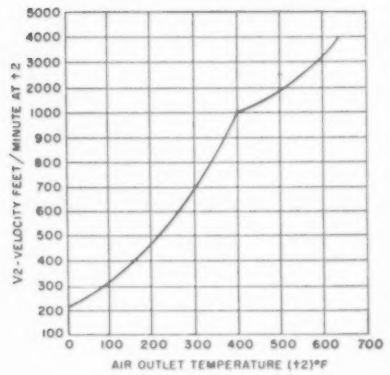
I USE TO DETERMINE LOSSES THROUGH INSULATED WALLS



II USE TO DETERMINE LOSSES FROM ENDS



III USE TO DETERMINE VELOCITY OF AIR



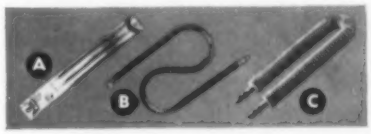
IV This Table Lists Specific Heats

Substance	Average Specific Heat	Weight in Lb per Cu Ft
SOLIDS		
Aluminum	0.23	160
Antimony	.052	423
Asphalt	.40	65
Beeswax	...	60
Bismuth	.031	610
Brass	.10	525
Brickwork and Masonry	.220	140
Carbon	.204	...
Copper	.10	550
Glass	.20	165
Graphite	.20	130
Iron, cast	.13	450
Iron, wrought	.12	480
Lead, solid	.031	710
Lead, melted	.04	...
Nickel	.11	550
Paper	.45	58
Paraffin	.70	56
Pitch, hard	...	83
Rubber	.40	95 *
Silver	.057	655
Solder (50% lead—50% tin)	.04	580
Steel	.12	490
Sugar	.30	105
Sulphur	.203	125
Tallow	...	60
Tin, solid	.056	455
Tin, melted	.064	...
Type metal (85% lead—15% antimony)	.040	670
Wood	.45 *	34 pine 50 oak
Zinc	.095	445
LIQUIDS		
Acetic acid	0.472	66
Alcohol	.65	55
Benzine	.45	56
Ether	.503	46
Glue (mixed 2 parts water, 1 part dry glue)	.895	69
Glycerine	.58	79
Mercury	.0333	845
Oil, cottonseed	.47	60
Oil, machine	.40	58
Oil, olive	.471	58
Paraffin, melted	.71	56
Petroleum	.51	56
Sulphur, melted	.234	...
Turpentine	.41	54
Water	1.0	62.5

	At Constant Pressure	At 70 F Atmospheric Pressure
GASES		
Acetylene	0.35	0.073
Air	.237	.080
Alcohol	.453	...
Ammonia	.520	.048
Carbon dioxide	.203	.123
Carbon monoxide	.243	.078
Chlorine	.125	.20
Hydrochloric acid	.195	.102
Hydrogen	3.41	.0056
Methane	.60	.0447
Nitrogen	.245	.078
Oxygen	.218	.09
Sulphur dioxide	.155	.179

Here is condensed information to help you get the most economical electric heaters for your oven and process air design problems.

Generally, strip heaters (a) or tubular heaters (b) are used for natural convection applications. For forced convection heating, fin-tubular heaters (c) are most desirable.



Here's how you figure the amount of heat required:

1. Using the formula, lbs of material × specific ht × temp rise (F) over 3412 = kwh required, figure heat requirements for the conveyor.
2. Using the above formula, figure heat requirements for the material to be heat treated.
3. Figure total area, in square feet, of top, bottom and both sides of the oven. Check Table I to find total kwh losses. Adjust for insulation.
4. Figure area of both end openings in square inches. Multiply times factor found in Table II.
5. Figure in square feet, the area of the duct. Check Table I for losses. Adjust for insulation.
6. Figure cubic feet of volume of oven and duct. Find weight of air at room temperature from Table IV. Multiply your answer times total cubic feet times number of air changes needed per hour. With this answer, use formula from Step 1 above to find kw needed for air change losses.

Total the answer arrived at in the 6 steps above. Add 3 kw as a safety factor. You now know how much heat is required. For more complete information, send coupon below or call your nearest General Electric Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y.

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Please send GEA-5096, "Heating Process Air" and GEC-1005, "Catalog of G-E Heaters and Devices."

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GENERAL ELECTRIC

WHAT'S HAPPENING IN... Science

New gage for the meter

It looks as though, at long last, a wavelength standard for the meter will be adopted next year; and that it will be based on the light emitted by a radioactive isotope.

More than three-score years have passed since the idea of using a wavelength of light as a reference point for the yard and meter was first proposed. But a platinum alloy bar, reposing in Paris, is still the reference for the meter; and, because the two are tied together (see box right for new values), also for the yard.

Our own scientists have proposed an atomic-beam standard based on mercury 198. But the orange line of krypton 86 seems to be favored by Canada and most European countries and likely will be the standard adopted by the International Conference on Weights & Measures when it meets next year. This line is reproducible with an accuracy of 1 part in 10^8, and should end forever the problems involved in measuring and maintaining a sensitive metal bar.

THE NEW YARD AND POUND

On July 1, the new international equivalents for the yard and pound went into effect, replacing the present conversion in which 1 yd = 0.91440813 m; and 1 lb = 0.4535924277 kg. Here, for ready reference are the official figures:

International yard
= 0.9144 metre
International inch
= 25.4 mm
International pound
= 0.45359237 kg

(Note: for background information on the original announcement, see *PE—Jan 19, p 16.*)

Relativity: Unproved theory?

Einstein's theory of relativity is generally accepted. Yet, according to a recent NASA report, only one of the three general tests of relativity can be said to have been fully successful thus far. This one is based on the motion of the planet Mercury, which does show the aberration predicted by Einstein's theory.

The second test, based on the bending of light in the sun's gravitational field, has been made many times, and the results seem to back up the theory. But, says NASA, "in view of the smallness of the effect (only 1.75 sec of arc), there is still room for reasonable doubt about the confirmation."

The third test—shifting of light toward red wavelengths in a strong gravitational field—has given some confirmation but the evidence is doubtful. Observations are confused by mass motions of gases. A red-shift is observed in some white dwarf stars, but even there it cannot be unequivocally said that this is not an effect of mass motion.

Because, at the present time, Einstein's general theory of relativity is "the best theory of the nature of gravitation," and because an understanding of gravity is so vitally important to space flight (*PE—Mar 10 '58, p 14*), these tests, and others being devised, are scheduled to get a real workout in the next few years. One of the reasons NASA is going ahead with its plan to put in orbit a satellite carrying a very precise clock is to test the Einstein prediction that the clock's speed will change as the strength of the earth's gravitational potential changes.

They go faster if they're not pure

Impurities speed evaporation of liquids, Victor LaMer and Geoffrey Barnes of Columbia U told the National Academy of Sciences. Studies of thin films (monolayer) spread on water show that certain impurities markedly diminish the effectiveness of the monolayer and its ability to retard evaporation, particularly at low surface pressures.

Most often, the offending impurities are those in the base liquid itself; but they may be in the monolayer, and they may be picked up from the air. It takes only the tiniest amount of the offending impurity to do the job. Say LaMer and Barnes: It appears that the evaporation resistance of a monolayer is much more sensitive to impurities in the sample than are most of the physical and chemical tests that are normally used as criteria of purity.

Previously, any observed increase in evaporation rate was attributed to the way the monolayer was spread on the liquid. But, LaMer and Barnes now say, the evaporation resistance of a monolayer is independent of the spreading technique used.

briefs . . .

It's not very much colder out in the wide blue yonder than right here on earth—not for the first 50 mi. anyway, recent NASA reports indicate. Lowest recorded temperature in the Antarctic (−125F) was reported last year by the Russians (*PE—Nov 3 '58, p 8*). But 65 mi. out into space, it's not much more than −100F.

Temperature does not drop evenly as one goes out, though. The temperature curve is a ragged one. In contrast, NASA says pressure and density decrease by about a factor of 10 for each 10 mi out in space.

Abstracts of Soviet technology in the petroleum field, including chemicals and lubricants, are being made available on a regular basis by the Central Abstracting Service of the American Petroleum Institute's Division of Refining. Special feature of the new service is the speed at which information is supplied. The 26 Russian periodicals being covered are flown to the US, and abstract bulletins are published on a biweekly basis. Cost to non-petroleum companies is $500 to $600 a year. —ARG

WHAT'S HAPPENING IN...

Materials

Boosting steel's shock strength

Stress ratings of low-carbon steels can be increased as much as 50% when loads are applied in rapid, short-duration cycles, as compared to static or extended-cycle dynamic loading, says the Mechanics Div of Naval Research Lab.

Tests show the dynamic stress may be as high as 1.5 times the static yield stress before gross yield will occur, if load cycles are on the order of ½ millisec. But NRL researchers have also found that when a specimen is given an impact load (an elastic shock) slightly below its dynamic yield stress, its mechanical properties are considerably altered in a way that affects subsequent loading.

Work is continuing, aimed at uncovering additional information on the nature and cause of yield. But an interim report has been prepared and is to be made available through OTS, Dept of Commerce, Washington 25, DC, as PB 151685.

Too hot for Ti?

Will planes of the next few years be operating at such high temperatures that titanium cannot be used? No, says Defense Metals Information Center.

Although service temperatures will rise, airframes "for all but one or two systems . . . will be cool enough for extensive titanium usage."

"On a strength-weight basis," the latest DMIC report (#17) continues, "it now appears that titanium alloys will, in general, be the most efficient structural materials available for service up to 1000 F"—particularly in view of its low density which may favor titanium "even where, theoretically, it is not the most efficient material."

However, in power plants, particularly those in the Mach 3-and-above category, a range now being proposed for commercial as well as military craft, "titanium will have relatively less application potential than heretofore because operating temperature for a larger portion of the engines is above the titanium use-range". Titanium usage in missiles will not be great, either, until titanium alloys can demonstrate a "marked superiority over steel for welded rocket motor cases" and there is "a large reduction in the price of reasonably weldable high-strength titanium-alloy sheet."

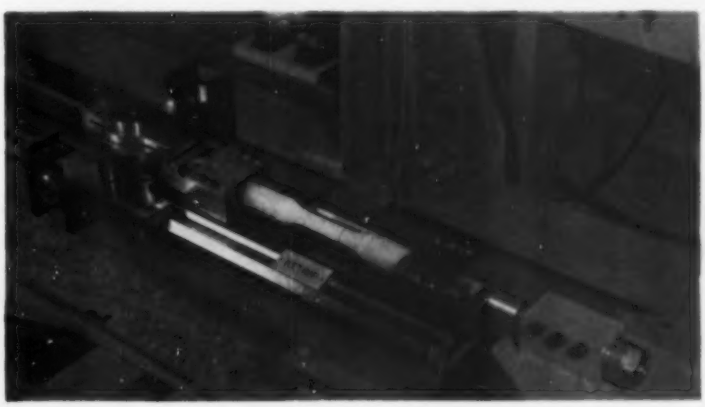
briefs . . .

A peening process that uses glass beads as the working material is claimed to cold-work, stress-relieve, and increase fatigue life of metal, and to improve surface finish. Perfecto-Peen, PO Box 10627, Dallas, is the developer. —ARG

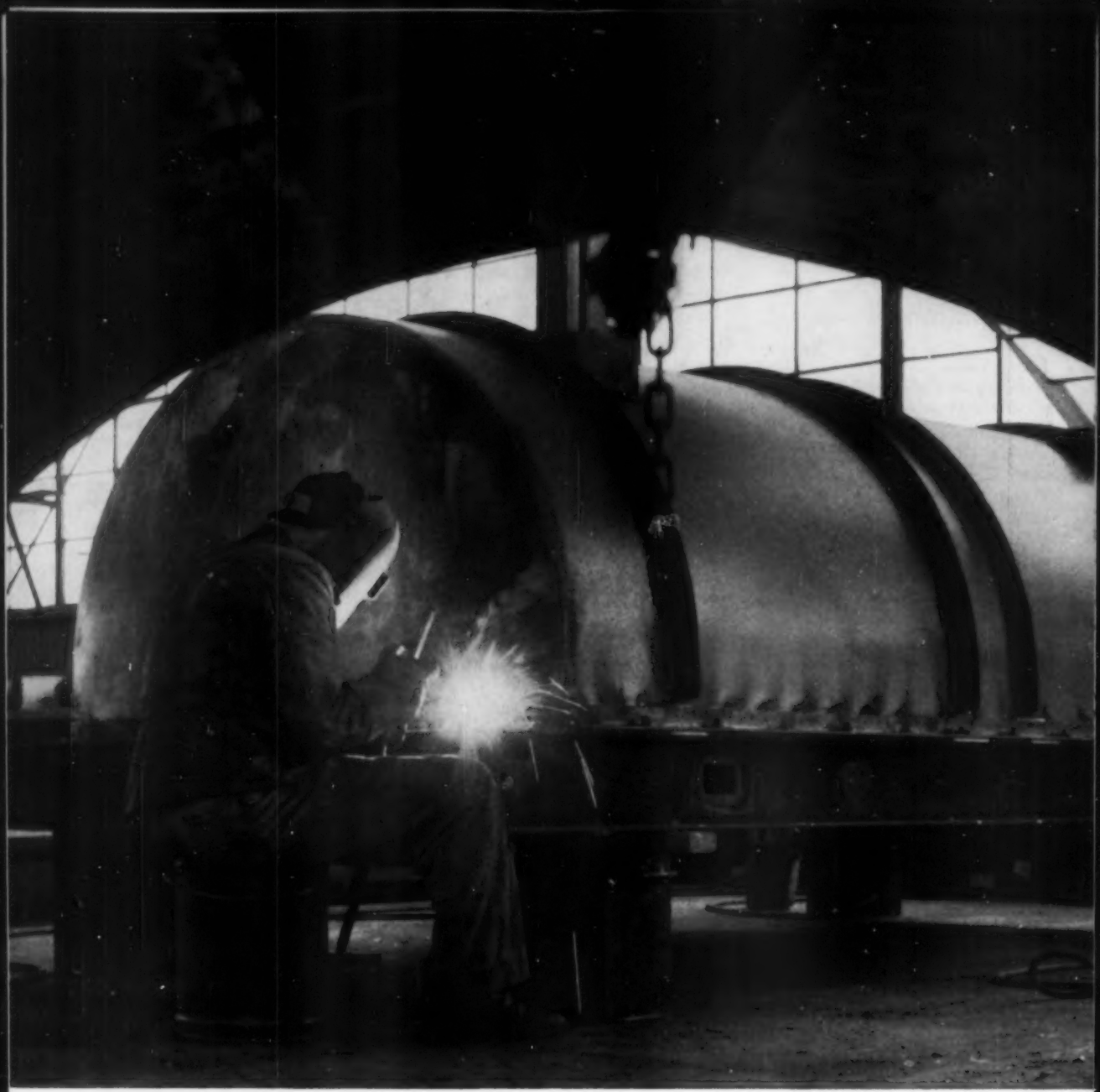
Double-action tester for plastics

Both impact and shock resistance can be measured by this pendulum-type machine, the Navy says. Developed by North Carolina State College for the Bureau of Ships, the RETIMP (Raleigh-Edwards-Tensile-Impact Machine) aims to overcome the limitations of Charpy and Izod tests as applied to plastics. Says the Navy: "It may be used to investigate any existing relationships between impact resistance and rate of loading."

Three measurements are made: energy of the arm at its release angle; kinetic energy of the arm immediately after impact; energy lost by the arm but not traceable to fracture effort.



Impact machine takes unnotched specimens (¼ to 1¼ in. dia) and subjects them to controlled shock by means of tapered pendulum. Specimen holders have self-locking tapered jaws.



How to contain a jet engine

THE BALTIMORE STEEL COMPANY makes shipping containers for aircraft engines, torpedoes, missiles, and other ordnance items. The containers are designed to accompany their cargo almost into the enemy's teeth. They are impact-resistant, shock-mounted, hermetically sealed, pressurized and humidity-controlled.

There were three reasons why the designers selected USS COR-TEN High-Strength Low-Alloy Steel for the outer shells of these containers:

1. The contents demand that the containers be strong and impact-resistant . . . tactics demand that they be light and maneuverable. USS COR-TEN Steel has a minimum yield point of 50,000 psi—50% higher than carbon steel—so it can be used in stronger, thinner, lighter gages, saving as much as 100 lbs. per container.
2. To permit storage in the field, the containers must be highly corrosion-resistant, and USS COR-TEN Steel has four to six times more atmospheric corrosion resistance than carbon steel. The containers are reusable—have a service life of about ten years.
3. COR-TEN Steel saves money. First, its strength permits the use of *less* steel, cutting production costs an estimated 8%. Second, maintenance costs are reduced because paint life on COR-TEN Steel is 50 to 100% longer.

U. S. Steel produces three brands of High Strength Steels—COR-TEN, TRI-TEN, and MAN-TEN, in addition to the remarkable USS "T-1" Constructional Alloy Steel, and a complete line of stainless steels. Each has characteristics that make it ideal for special design applications. For complete information about these "steels that do more," write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

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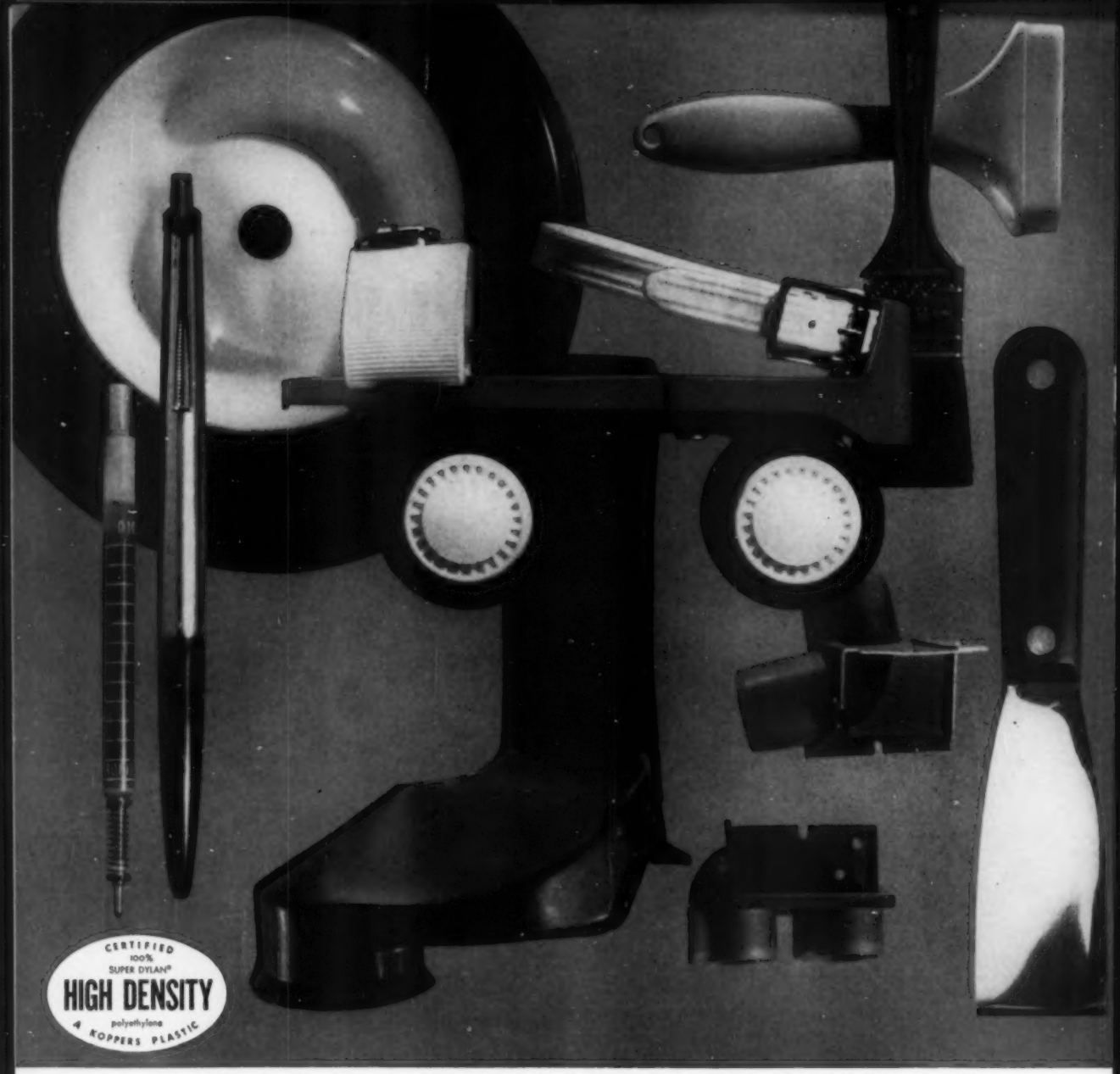
MR. C. EDWARD BELLEW, CHIEF ENGINEER, THE BALTIMORE STEEL COMPANY



SUPER DYLAN polyethylene
gets to the heart of tough design problems

Light-duty wheels—where a tough, rust-proof, light-weight, easily moldable material is needed—SUPER DYLAN.

Putty knife and paint brush handles—where a low cost, durable material, to which paint will not stick, is called for—SUPER DYLAN.

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KOPPERS

CIRCLE NO. 18 READER SERVICE CARD

Product Engineering HORIZONS

July 27, 1959

WHAT'S PAR?

Some years ago, when craftsmen built our house, we had literally to move in so they'd call the job done. Each day, there seemed to be little things to do—trim to smooth, paint to touch up, a pipe to straighten, a window to loosen. It was very exasperating at the time, but I've thought since that this final fitting and fiddling is what makes the difference between a craftsmen's and an ordinary job in anything, be it house, furniture or new tool.

I had an uncle who was known as a master toolmaker, but he never became anything else. He couldn't keep a helper—demanded too much. He rarely got a job done in a hurry, but when he finished with it, it was dead right. Perhaps he was too much the craftsman, too much the perfectionist for our time-conscious world.

There is, of course, the opposite situation, too—the man who never gets a job done, or never gets it right, or who quits too soon, or never really solves the problem. The belief has always been that such a man is just careless or disinterested.

It can even be a group problem—witness the parts missing or inadequately secured on cars, appliances, and other present-day products. The tendency has been to believe that these things are the result of resentment or boredom or fatigue—that building the worker's job interest would overcome them. And in small companies and single groups in large companies, it seemingly has. Research has seemed to indicate that a gang spirit, built by a particular person, can overcome these difficulties. But, sometimes, the spirit is there and the results are not.

Now, however, several groups of psychologists have come upon another answer. They were trying to find out how to get higher-quality work, and found, to their surprise, that the workers who overdo as well as the workers who *underdo* feel that they have just completed the job. The fact is that people are people again in this case: *no two individuals really agree on when a job is done.* In psychological lingo, more than half of the people have a faulty "se ıse of closure." They really don't know when the job is done. More tend to underdo than to overdo, and the number who hit the right moment to stop is somewhere between two and four in ten.

This is an interesting finding, but what can be done about it? Is there any way to even out results? Psychologists say there is. One thing is to examine your own sense of closure to see if that's faulty. The next thing is to study subordinates, advancing those who have a good sense of closure and advising those who don't wherein they fail.

There are three major steps to proper placement of the sense of closure.

1. *Set par on the job.* Make responsibility clear and definite. Tell what you expect, how much, and when.

2. *Hew to the line.* Excuses are *not* an acceptable product. If you are soft-hearted and show interest in them, that's what you'll get. Have mercy, but don't strain it.

2. *Check performance.* Establish the identities of over-performers and under-performers. Be sure a problem or a question presented to you is accompanied by a suggested answer, that one person or one group does not have to complete another's work, that all concerned know process steps before and after their own, that no "temporary solution" or "getting out from under" becomes permanent. And check yourself, too: How many of your last-year's problems are still waiting for final clean-up?

Special Fasteners

Bethlehem makes the widest variety. Those you see here are just a small sample of the steel specialties we can produce. And our fasteners engineers will help you design products, whether they are headed, threaded, slotted or pointed. Try us. Our Lebanon, Pa., plant is geared to turn out your order fast.

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BETHLEHEM STEEL

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Europe's New Cars to Meet US Competition

England, France and Germany are not giving up the rich American market because of the Detroit entries. They are, in fact, countering with more models, redesigned appearances, and engineering changes.

NEW YORK—The impending emergence of the US compact car, (still not as small as European models), has convinced European car makers they should rush to market different versions of their present cars which will be directly competitive with Detroit's. In addition, the Europeans are pressing for new designs in all of their models as never before.

European interest in a slightly larger version of their small car is not dictated solely by consideration of US competition. The fact that consumers here show an interest in a car that costs a bit more than the minimum, and offers more riding comfort is conditioning their approach. Yet, not by a long shot are Europeans abandoning the sure-fire market for their 1-liter and smaller models in the $1200 to $1800 price range. These, now established as truly "economy" cars, will still command a growing market (goal in US: 1,000,000 cars annually). This will be especially true until the US Big Three can offer models smaller than the compacts. American Motors' Rambler, Studebaker-Packard's Lark, Ford's Falcon, Plymouth's Valiant, and Chevrolet's Corvair, although a departure in design from US conventional cars, must necessarily be classified in the category of next-to-small cars in size.

Of particular significance despite their seemingly secure market in the US, European small-car makers are instituting extensive design and model changes on 1960 cars, even to the point of expending large sums for retooling. Various reasons have been given, but most logical appears to be that Europeans are convinced their product will always bear prestige; that low price can persuade more and more Americans to consider shelling out $1200 to $1800 for a second car; in addition to the $3000 or more they've already paid for a larger US car. According to a number of European manufacturers, such US buyers may represent a sizable market for European car makers in the future.

NEW DESIGN ABROAD

In England . . .

British Motor Corp is soon to introduce a small front-wheel drive car designed by Issigonnis, Britain's leading designer of mass-produced cars. Most likely configuration is a largely standard BMC water-cooled engine and transmission but mounted transversely between the wheels. Transverse engine mounting minimizes modifications needed to install engine and gear box to drive front wheels. Spur and bevel gears eliminate need for crown wheels, simplifying machinery problems.

British Ford, contrary to rumor that engine would be rear-mounted, will stick with orthodox engine-transmission layout. But look for different body styling with independent springing all around.

Rootes is introducing new Sunbeam model which will feature the Smith's automatic transmission using a magnetic powder clutch. Also, the Sunbeam will have disk brakes on all 4 wheels. Another model from an unknown maker will introduce a Hobbs automatic transmission on a 1-1.5 liter model. This also has a magnetic powder clutch but uses epicyclic gearing.

Standard Motor Co has already unveiled its Triumph Herald (see photo) which has separately sprung wheels, a turning circle of 25 ft and pre-packed bearings throughout the chassis to eliminate all greasing. Collision repair is simplified by 7 bolt-on body sections instead of the former all-welded unitized construction. The Herald's rear springing although not new will be used for the first time on a mass-produced car of conventional design anywhere. (For design details see *PE* Aug 17, '59)

Britain's aggressive approach to small car market is evidenced by their Joint Industry Research Association activity which will enable British car makers to equip all their small cars with automatic transmissions.

Standard Motor Co's Triumph Herald

In Germany . . .

Volkswagen, despite repeated denials by Heinz Nordhoff, president of Volkswagen Works, of a design change, rumors persist that the presently-used vertical fan assembly will be tipped down flat to allow the power unit to be moved forward several inches. This should substantially improve the recognized poor position of the center of gravity on the Volkswagen. By moving the engine unit forward, the presently cramped luggage space would be increased.

It has also been rumored that a Volkswagen body more like the Karmann-Ghia (and Claravelle) has been designed, and that a longer, 1500-cc (as compared to the present 1192-cc) engine of 45 hp (9 more) will be ready if sales begin to sag. Significance of changes in Volkswagen's profile lie in the fact that this firm has stood pat on appearance design since the end of World War II.

B.M.W. of Munich, producer of the Isetta series, has unveiled a $1200 700-cc sports coupe equipped with an air-cooled, twin-cylinder O.H.V. engine developing 35 hp at 5200 rpm, and giving 40 mi per gal. Front fenders are bolted on rather than welded. B.M.W. will also offer in September a new 1.6-liter engine which has already been tested successfully in standard B.M.W. models.

In France . . .

Citroen will have in 1961 or '62 a 3-hp model powered by a beefed-up version of its reliable 2CV front-drive traction package. Body lines will prob-

ably resemble those of the frog-faced DS-19. Fuel injection may also be at hand for Citroen: the company recently announced that it is prototype testing a fuel-injection gasoline engine on a 6-ton truck. Citroen's position sums up that of most major French car makers. Scoffing at reports it will put a turbine-powered model on the market this year, Citroen officials don't deny their design departments are working overtime to meet the fierce competition developing throughout Europe.

Renault will offer this year the Italian-style Floride (known as the Caravelle in the US) whose mechanical elements are derived from the Dauphine. The sleek body is built on a standard Dauphine chassis; the rear engine drive package is similar to the Dauphine but the motor is beefed up to 40 hp SAE. This was done without changing the 845-cc capacity of the basic engine. What Renault did was to step up the compression ratio to 8:1, alter the distribution setting with a new camshaft and enlarge the inlet gas flow passages from the carburetor choke all the way up to the inlet valves.

Panhard is planning to offer the PL 17 with a restyled body and slight mechanical improvements. The car equipped with front-wheel drive is powered by a flat-twin, aircooled engine developing 42 hp in the standard version and is said to get 39 mi per gal.

BIG-3 ENTRIES

European car makers do not deny that Detroit is perfectly capable of grabbing off a sizable chunk of the small-car market and, by improved design, pose an increasing threat to their up-to-now exclusive preserve.

A rundown of design features of the Big Three's compact entries dispel any doubt that the Corvair, Falcon and Valiant are not radical departures.

Chevrolet's Corvair represents the most radical design departure. It will have an aluminum aircooled, pancaked 6-cylinder engine mounted in the rear along with all driving mechanisms. It will have a 108 in. wheel base about the same as the Rambler's. The pancake engine will develop 90 hp, more than enough to power efficiently the 2250-lb Corvair at a cruising speed of 70 mph. The rear engine will also eliminate the transmission tunnel hump along the floor of the car—Ford and Chrysler are satisfied to substantially reduce the size of the hump.

There has been considerable sniping by Ford and Chrysler at the GM rear-engined design epitomized by the "put the engine up front where it belongs" line of advertising. Taking exception to this criticism, Chevrolet recently staged a full-dress technical press conference starring Maurice Olley, and an ex-GM executive.

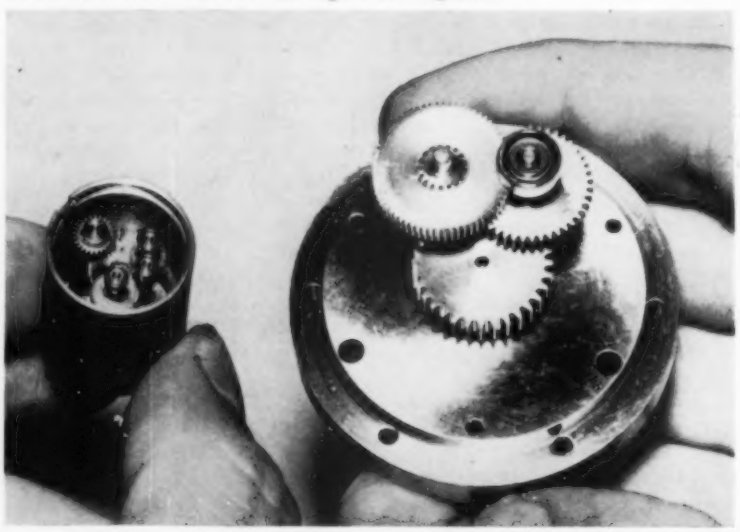
Olley pointed out that a Corvair-like model has an ideal weight distribution (40% front, 60% rear) when low profile, long-cord (EP degree cord angle) tires are used with specific air pressures of 15 psi in front tires and 26 psi in rear tires. Even poorly designed (sic) rear-engined cars give good traction on icy, snowy roads, he added, since the lightly loaded front tires pave the way for the rear tires.

Referring to difficulties created by crosswinds in existing rear-engined cars, Olley laid the blame to overloading rear tires, and said solution was achieved by adding or subtracting free air in these tires.

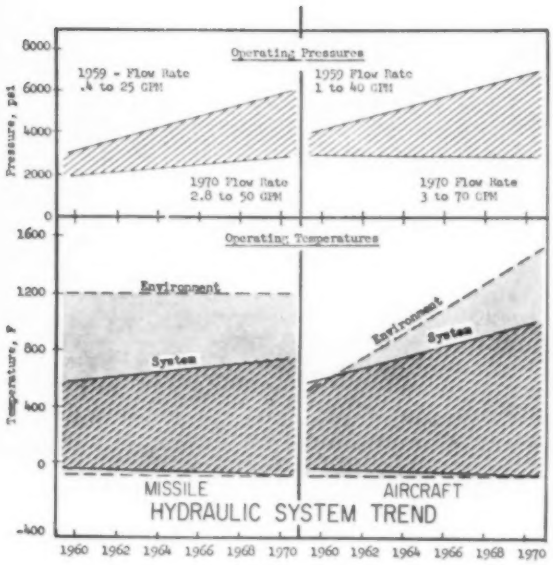
All the Big Three entries feature unitized body construction and independent suspension of the rear wheels. In length and width (and horsepower) the Ford-Chevrolet-Plymouth group resemble the relatively short, narrow 6-passenger 1949 models of these companies. But average weight is 1400 lb less. More efficient driving performance is offered—approximately 25 mi per gal as compared to under 15 mi per gal attained by most US cars today. Automatic transmissions on the compacts, though optional, are simpler and less expensive than on big cars. Wheel bases will not exceed 109 in. while styling will be simple. But price will range from $2,000 to $2,800 depending on extras.

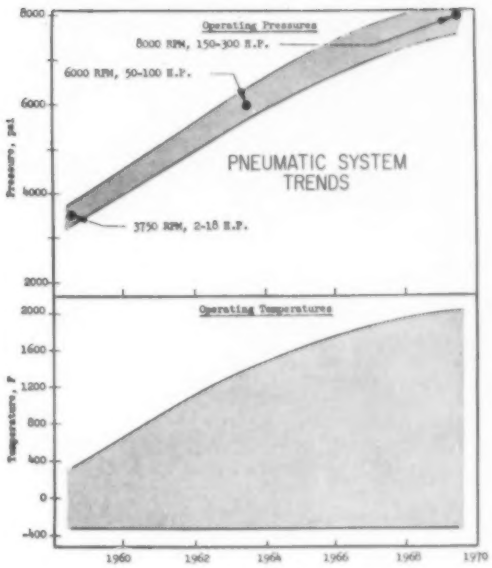
Far from abandoning its big and so-called medium-sized model, Detroit figures only to augment its sales from hoped-for 6,000,000 annual sales of conventional car products by selling an additional million compacts. In the next few years, US carmakers hope that European small car sales here can be held to one million maximum and Detroit can't help but be the long-run heavy favorite if only because of its vast research, engineering, manufacturing, sales and promotion facilities. ■

Ever Smaller Gear Packages Designed



Gear packages like many another part assembly, must meet ever-diminishing size requirements for US missiles. Gearhead at left produced by Bowmar Instrument Co was reduced from larger unit at right over period of 8 yr. Greatest speed increase in gearhead design by Bowmar is from 7100 rpm to 100,000 to drive an octagonal mirror on high speed closed circuit TV camera taking 800,000 photos per min. Largest speed reduction is reducing 1 rpm to 3 revolutions per 24 hr. Company has produced ¾ oz transmissions that can increase torque from a 0.3 in-oz input to an output of 540 in-oz, using motors of 0.00008 hp. Gearhead prices range from $20 to $2000.





To Keep US in Space: Shopping List

WASHINGTON—A report on engineering achievements needed to keep the US in a dominant aeronautic and astronautic position has been compiled by the Aerospace Industries Association (AIA). Divided into two sections—engineering trends and requirements, and manufacturing trends and requirements—it shows the problems facing aerospace engineers during the next decade.

ENGINEERING FORECAST

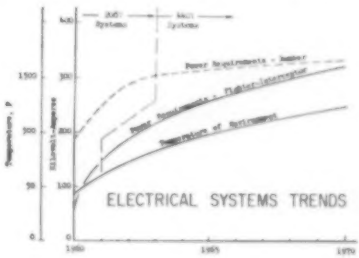
Some of the predications and problems:

- Increasing heat environments will limit aircraft speeds to about Mach 4 (2500-2700 mph). Re-entry velocities for missiles, satellites and gliders will create short-time temperatures as high as 10,000° F.
- Inertial guidance and control systems will show a marked increase in the next 10 yr. Doppler-inertial and stellar-inertial will be in considerable use by 1965 in both second-generation missiles and space vehicles; by 1970, application of systems using the principles of celestial mechanics will be common.
- Development of reliable gas-lubricated spin bearings (*PE—Nov* 25 '58, *p* 99) and the refinement of electrostatic suspension for gyros and accelerometers must be perfected by 1965 for these systems. The application of cryogenics to systems, particularly bearings, must be completed by 1970.
- High-strength, high-temperature demands in airframe, missile and spacecraft manufacture will require increasing use of high-density metals (*PE—Jul* 21 '58, *p* 62). In many applications, weldments will replace castings.
- Natural rubber will decrease during the next 10 yr, as will neoprene consumption, and buna N base polymer will be replaced by high-temperature and ozone-resistant polymers. RTV fuel-resistant silicones and urethanes will become more important as sealant base polymers. While fluorocarbons offer the best immediate answer for high temperature, high physical property and field resistance, fluorosilicones and nitrile silicones will increase in importance because of their lower density values.

MANUFACTURING FORECAST

The time cycle from conception to production is becoming shorter while methods and equipment are becoming more complex. To meet these challenges, more complex tooling, manufacturing methods and equipment must be developed in shorter time spans. Specifically, here's what will be needed:

- New materials will require new facilities for handling. Automation and numerical control must be expanded, and present testing equipment lacks the sensitivity for future needs. New standards of quality control and data evaluation must be developed.
- Closer tolerances must be achieved. This, with brazing, welding and heat treating in carefully controlled atmospheres are two major manufacturing and tooling problems.
- Ceramic adhesives (*PE—Jan* 27 '58, *p* 17) and bonding of extremely large contoured parts are definite requirements in the next 10 yr. Bonding steel will be commonplace.
- Fabrication techniques must be developed in the next decade to permit shape fabrication of high-strength steels with yield in excess of 300,000 psi and titanium alloys with strength yields in excess of 200,000 psi.



REPORT COMPILATION

Some 200 research and engineering experts employed in the aerospace industry, members of the AIA's Research and Testing Committee. And bonding structures capable of withstanding temperatures of 600 F will also be customary.

(CONTINUED ON PAGE 38)

Now on the market! Hundreds of new products made with MARLEX*

Here is the latest display of commercially available products made with Marlex linear polyethylene. These new items range from tiny ball point pen parts to large housings for lawnmowers and TV sets . . . from thin, clear packaging film to heavy-duty bag material . . . from colorful fabrics to high-tensile rope that floats. Manufacturers are turning to Marlex because it is an economical material that can be precision molded, formed or extruded. And everyone recognizes the advantages of using Marlex for high-quality, yet inexpensive housewares and toys that are boilproof and virtually indestructible.

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Manufacturing equipment, Tooling and Test Committees, worked on the various sections. The report data are gathered from unclassified information and the AIA points out that organizations having access to classified data and planning documents may wish to modify the predictions. These are all long-range predictions prepared in the light of current knowledge, and judgment should be exercised in applying these data to specific development programs or research objectives.

Detailed background data which was accumulated on specific subjects is available from the AIA office. ■

Soviets Redesign School Curricula

Moscow—The USSR's Ministry of Education and Academy of Pedagogical Science are circulating drafts of a new academic curricula for elementary (or so-called 8-year schools) and secondary-labor polytechnic schools.

The 8-year school will replace today's 7-year school and will add 1015 hr of academic and polytechnic training. A major change in the proposed curricula is a regular work program for pupils, designed to prepare them psychologically and practically for

Die Cast Aluminum Engine Design Patented

A patent on the design of a die cast aluminum V-8 automobile engine block has been issued to Alfred F. Bauer, chief engineer for Doehler-Jarvis div, National Lead Co, shown here examining a section of the new block. The design, applicable to all V-8 engine blocks, is said to eliminate undercuts, projections and blind passages, and allows for the efficient mass production of engine blocks by die casting. Smooth, uniform lubricating and cooling passages are cast directly into the aluminum block, permitting unobstructed flow of the fluids used. As aluminum blocks develop more horsepower per unit weight than the conventional sand cast gray iron blocks, substantial savings can be realized through the small amount of machining required on die cast blocks. Weight of a die cast aluminum block for an average V-8 engine is 55 lb, a weight saving of more than 150 lb over a block in gray iron. The Bauer design takes full advantage of the high thermal conductivity of aluminum, which makes possible the use of smaller water channels and radiator, an added weight advantage.

taking jobs as Soviet Union adults.

The Russian language will be taught throughout the 8 years, and greater emphasis is proposed for conversation in foreign languages. In the natural sciences, a relatively complete survey of plants, animals, the human body and development of the organic world is suggested. The physics program will include considerable theoretical and lab work calculated to build a solid foundation for study of mechanical or electrical engineering. Music and singing will be taught through all grades and drawing through 7 of them.

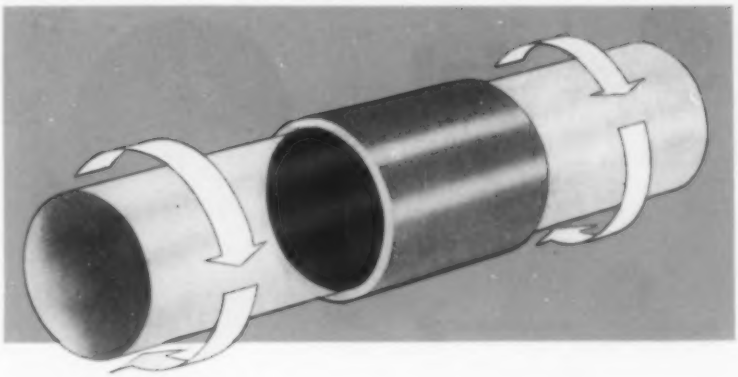
Under the work program, school children between 5th and 8th grades will have classes in shop, agriculture and home economics, and in 8th grade they will get rudiments of mechanical and electrical engineering. Additionally, students in these grades will spend two academic weeks tending public parks and gardens, and working on public improvements and collective farms. From the 3rd grade on, all children will spend two hours a week tidying classrooms, repairing furniture, working in libraries and otherwise helping maintain school property. As much as 20% of student time will be spent on such labor training within the school.

Secondary schools will dovetail with the 8-year school and with higher educational institutions and trade schools. Programs in mathematics, biology, chemistry and physics will take account of recent scientific and technical advances. Physics, for example, will be broadened to include atomic science, ultrasonics, semiconductors and physical properties of plastics. ■

Italy Plans 4 Polytechs

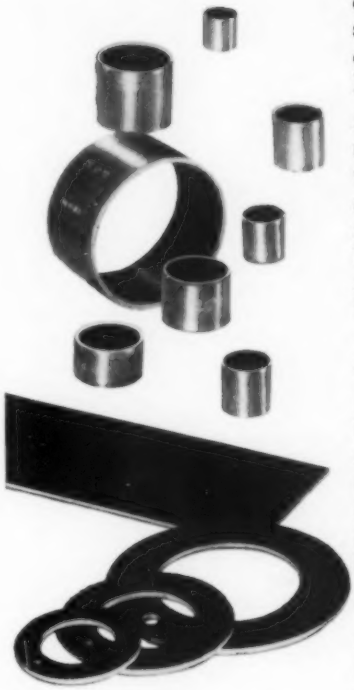
MILAN—Four new engineering institutes will be built on the Italian peninsula by 1962. Two of the schools will be located in Southern Italy—Naples and Bari. Also one in Sicily and another in Sardinia. The construction, costing upwards of $10 million will cover main buildings, laboratories and student housing facilities.

The projects for the polytechnics of Naples and Bari have already been approved and $5 million in funds ap-



NEW GLACIER DU DRY BEARINGS

allow sliding speeds 5 times greater than other dry bearings



DU's excellent thermal conductivity dissipates heat generated through sliding friction. Under low load conditions, for instance, applications for DU are on record up to 50,000 rpm.

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propriated. The schools are expected to open in time for the 1961-62 academic year.

The Italian government has also agreed to contribute $2½ million to the Sardinia's Cagliari school. The Sardinian regional government which will match the Italian contribution. ■

R&D Duties Urged on Industry

BERKELEY, CALIF—Dr Lyman R Fink, top executive of General Electric's atomic products division in Palo Alto, proposes a 5-point plan to keep this nation ahead of the world in research and development. His views were aired before an audience of highschool teachers from 14 Western States who are studying at Stanford and the University of California on GE summer fellowships.

Dr Fink urged his colleagues in business to:

- Shorten R & D cycles for all goods.
- Avoid spectacular international competition for competition's sake. Free nations, he said, should prove their technical strength in areas where results are in the greatest public interest.
- Identify with the government those technical programs that will fulfill our national objectives, because the government depends on industry to achieve technical success.
- Review and improve business practices so industry deserves and can insure preservation of profits that comprise the free-enterprise system.
- Demonstrate to government, US citizens and the world that free enterprise can achieve technical success faster, better, cheaper, and with greater reward than any other system. ■

Congress Kills Limit on Engineering Costs

WASHINGTON—A provision which would have limited engineering and design costs to 5% of the total cost of any project has been eliminated from the Dept of the Interior's Appropriations Act for 1960.

Contested by the National Society

of Professional Engineers, the provision would have prevented consulting engineers as well as companies from negotiating with the government for fees beyond the 5% maximum regardless of size, complexity and special conditions of the project involved. The fee-limiting proviso was inserted by the House, but later eliminated by the Senate. ■

Japan's Eyeful Tower

Beneath this 1472-ft television antenna, serving Tokyo TV channels, is a 5-story science hall that houses industrial exhibits. The structure, also equipped with a sightseeing platform half-way up, was designed for maximum safety in the event of earthquakes or hurricanes.

CORRECTION

In the June 8th issue, the price of SUPRAMICA 620, a high-temperature ceramoplastic made by Mycalex Corporation of America, was incorrectly quoted. The approximate price is $3.12 per cu. in.–Ed. ■

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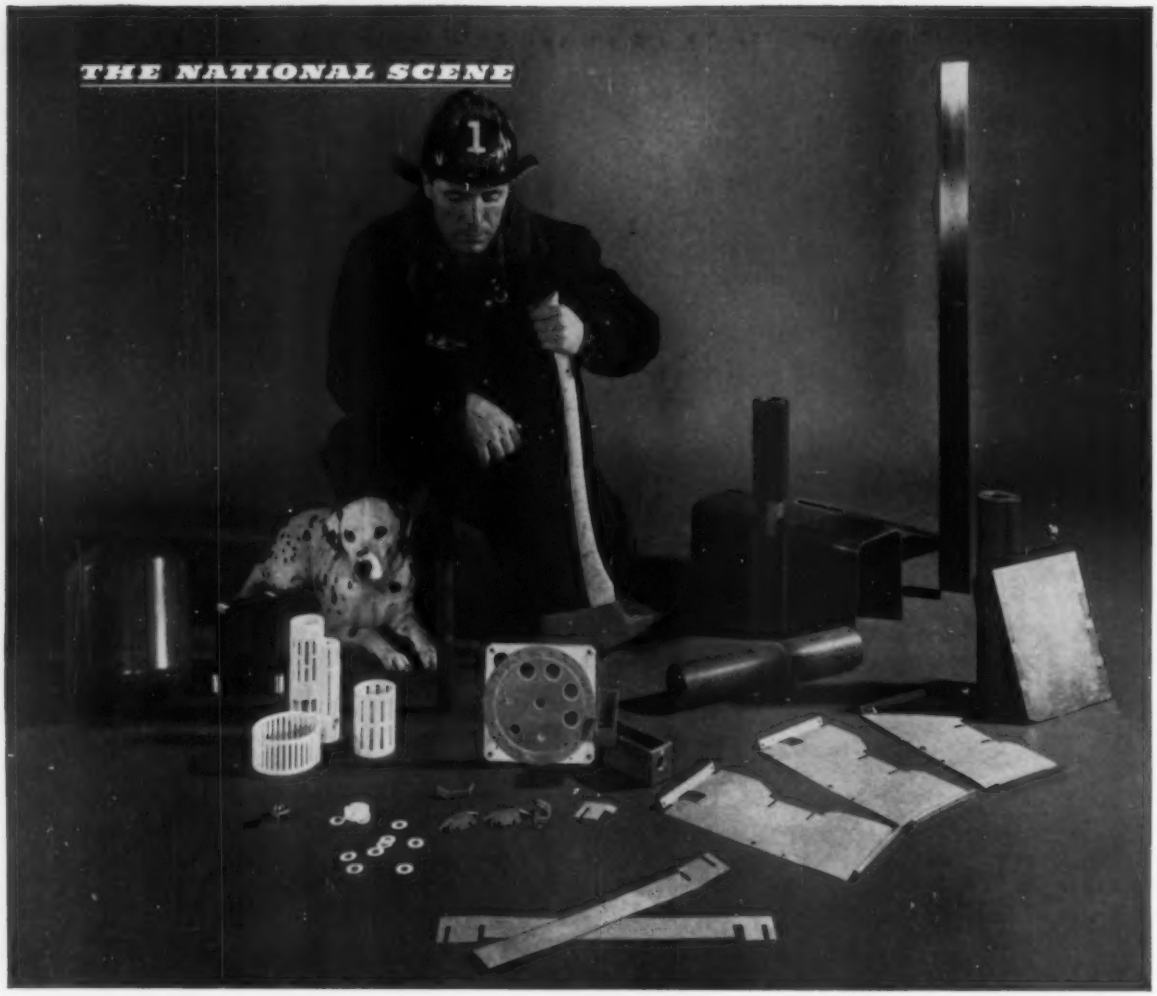

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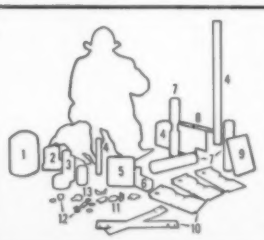
The "pay-off" comes in protection of lives and expensive equipment from fire, because these materials are self-extinguishing. As barriers, base plates, terminal boards, support members, printed circuits—National's family of flame-retardant materials is solving problems of fire containment and those involving *both* fire and electrical insulation.

Surprisingly, *low cost* is a feature of several of these materials. And since they mean more safety and product protection for the user, the "pay-off" also comes in the form of added product sales features.

Write for complete property values on these eleven materials, and let us know what your particular problem is. If you wish samples and price information, drop us a note on your letterhead. National Vulcanized Fibre Co., Dept. G-5, Wilmington 99, Delaware.

Grade	Base	Resin	Extinguishing Time (sec.) UL
PYRONIL	Cellulose	None	<1
X-121	Paper	Phenolic	2-4
X-122	Paper	Phenolic	1
XX-326	Paper	Phenolic	1½-2
XXXP-475	Paper	Phenolic	<1-1½
GP-9202	Glass Mat	Polyester	<1
GP-9204	Glass Mat	Polyester	<1
G-5-813	Glass Cloth	Melamine	<1
G-7-832	Glass Cloth	Silicone	<1
GH-871	Glass Cloth	Phenolic	<1
EP-491	Paper	Epoxy	<1



1. Weldor's Shield. **2.** Box. **3.** Coil Forms. **4.** Circuit Breaker Parts. **5.** Coil Form Base. **6.** Film Splicer Housing. **7.** High Voltage Bushings. **8.** Bus Bar Insulator. **9.** Printed Circuit. **10.** Portable TV Shields. **11.** Switch Shields. **12.** Switch Plates. **13.** Stand-Off Insulator.

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Griffin, Ga.	8-1308
Indianapolis	WAlnut 3-6381
Los Angeles	RAymond 3-0291
Milwaukee	BRoadway 6-6995
New Haven	LOcust 2-3594
Newark	MItchell 2-6090
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British Plastics Look Better Now

LONDON—Plastic products in England are at last beginning to evidence the influence of professionalism in design, according to Robin Day, a leading British industrial designer. Good design is being strongly backed by a government-sponsored body—The Council of Industrial Design—and design-conscious magazines. The recent Plastic Exhibition here showed better designs in consumer and industrial goods than were seen in the past.

Tableware, radio cabinets, domestic light fittings and similar products occasionally show a tautness of line and crispness of treatment that is refreshing to see in plastic products, Day said after viewing the show. Other types thoroughly satisfactory from a visual point of view are those with strictly functional or an industrial purpose—resin-bonded fairings to aircraft, and plastic components of machine and electrical equipment.

However, in between good industrial products and the more restrained consumer ones, comes a mass of shining, bulbous, vulgar articles which are the results of untrained persons making decisions about visual design, Day continued.

To generalize, it seems that British design in plastics is good in the simple unepretentious articles, but less successful when attempts have been made to introduce glamor and showy sales appeal. However, Day said, these overstyled objects are giving way to competently designed products by qualified industrial designers. ■

GE Develops Furnace for Rocket Cases

EVANDALE, OHIO—A large heat treating furnace capable of processing solid-propellant rocket cases up to 40 ft long and 10 ft in dia has been developed by General Electric Co here at Edwards.

Here's how it works: the rocket case after fabrication is lowered into one of the pit furnaces and heated to 900 F. The high-heat furnace will then be rolled around (not unlike a giant "lazy-Susan") on its tracks directly over the pre-heated rocket case. The case will be lifted into it by a built-in chain hoist. This circular arrangement of furnace components minimizes floor space and simplifies utility supply systems to the high-heat furnace.

As the rocket case is brought up to the required temperature, the high-heat furnace will move again to a position directly over a quench station where the case is lowered into the pit and cooled by air, molten salt and water agents. After cooling the case will move to still another pit furnace where it will be tempered and drawn to the desired hardness. ■

Molten Aluminum Trucked to Foundry

Aluminum in molten form (about 1790 F) produced by Reynolds Metal Co's St Lawrence reduction plant will soon be trucked in crucibles along a short roadway to General Motors Chevrolet foundry in nearby Massena, NY. In the crucibles, aluminum as produced by Reynolds' three St Lawrence potlines, can be retained in molten form for several hours. On arrival at Massena, the liquid metal will be die-cast to make the aluminum engine block for Chevrolet's pancake, rear-engine Corvair.

JOB HUNTING— FOR ENGINEERS

PETER L GARRETT
Santa Monica, Calif.

HOW TO

- **bypass Personnel**
- **write impressive resumes**
- **fill out employment forms**
- **get a salary worth working for**

"Systems" is the most popular word in engineering today. Therefore, I shall take the systems approach to job hunting. Just among ourselves, potential job-hunters all, we'll use the three-letter Anglo-Saxon word. Employers, of course, prefer *employment* and *position*.

The systems approach starts with knowing when to quit. If you've been fired or "laid off" (meaning: two or more people fired at the same time), then you have one less problem to solve. Engineers are overhead, and when the Board of Directors (who are the highest overhead of all) want to save money, the first place they look is down. Janitors are good, and so are secretaries; but an engineer is twice as good as either and besides, for a couple of engineers you can sometimes get a secretary thrown in.

And so we formulate the first law: QUIT BEFORE YOU GET FIRED. The first lemma of this law is not to become overconfident because of a recent small raise, sometimes phrased: BE LOYAL BUT DON'T TRUST THEM.

Now comes a psychological point: it's generally later than you think. When you decide to go, go! Don't ooze! The chances are they have seen that shifty look in your eyes and the employment page on your hands.

PERSONNEL DEPARTMENT

The larger a corporation, the slower it moves; and the insensitive skin that covers these mastodons is called Personnel. With forms, the Personnel Department protects itself from contact with the outside world. Any form worth its salt has three distinguished characteristics.

- It takes at least 1½ hours to fill out.
- It is designed to make you look like a slob.
- It asks at least one question that nobody has asked before ("What is the license number of your automobile?")

Personnel managers, of course, know nothing whatever about engineering and very little about the organization of their own Engineering Department. What they use in place of information are special forms, often flatteringly called "Personnel Requisitions." These are somewhat exaggerated job descriptions created by the man Personnel is keeping you from seeing. He exaggerates for two reasons:

- He hopes to imply to you that the job is much more interesting than it is.
- He wants something to show just in case you want more money than the lowest curve of the company's salary formula permits. (By the way, the personnel interviewer may not know Simpson's Rule from Murphy's Law; but he does know when an applicant asks for more money than he himself makes.)

The basic principle of dealing with Personnel people is to avoid them. To do this you need:

1) A resume.
2) Friends.

Take several employment forms and answer the questions that are not on your job history. Put these on page 1 of a vellum. On page 2 and following, put your job history, conspicuously labeled EMPLOYMENT HISTORY. If you are preternaturally honest (or if none of your previous employers has gone out of business), you can use a white-print of this for almost all employment forms and for security questionnaires as well.

WHOM DO YOU KNOW?

Now you are prepared to call your friends. Don't be shy. If you don't know them well enough to ask a favor, then you have nothing to lose by offending them. Let them all know you are available and why. If you have a sensitive conscience or a tendency to be excessively frank, remember this: Why you want to quit is purely subjective and subject to change between telephone calls. While I would not encourage anyone to lie, I should like to point out that there is a hierarchy of values involved. The final evaluation of a "reason for leaving" is, of course, up to the prejudice of the man you're talking to, but some general rules apply.

Boredom is good if you have been there long enough. But be as specific as possible because the new job may also be a bore. If the job were really important, somebody now on the payroll would have had it shoved down his throat. If it were interesting, an insider would have snaffled it. Therefore, do not dwell on boredom in general; be specific. If possible, be specific about something the new outfit doesn't do at all.

No advancement opportunities is another good "reason for leaving" and has the secondary value of pointing out, that money is a consideration.

After landing another job, the reason for leaving should change to *for professional advancement*, freeing *boredom* and *no advancement opportunities* for re-use. *For professional advancement* is a meaningless phrase and therefore does not conjure up unpleasant associations; furthermore, it has a pious sound like the running of water when the bathroom door is closed.

AGENCIES

After you have called your friends, you might as well call one or two of the better employment agencies. But remember; an agency is one more layer between you and the man you want to see. Fill out their form, and stuff the envelope with several of your resumes and a note telling them to MOVE. Now forget about agencies; you won't hear from them until the show is over.

CLASSIFIED ADS

Next consult the classified section of the Sunday paper. Mark the prospects. If you cannot dredge from your memory the name of a single man who works there, call Engineering Personnel and ask them to send you an employment form.

Chances are there is no Engineering Personnel, but this artlessly snobbish approach can save you a lot of time. If you are using your current employer's telephone, it can be important not to waste time with duplicate explanations lest the wrong person walk in on you. In addition you will avoid making out the wrong form. Long before a Personnel Department produces a branch called Engineering Personnel, it produces a bud, "our Mr Jones," and a special form. Mr Jones and his form cannot be avoided if the organization is approached from the bottom. The best you can hope for is to see the right man on the first try.

Four interviews a day is all you can manage; and your average will be more like two or three. You cannot sneak out often enough to do the job. Face up to your responsibilities and get sick for two days. Monday and Tuesday are good, logical days; and Wednesday morning you can complain about spending the long weekend in bed. If you stay up late Tuesday night making out forms, you'll look weary enough to play the part convincingly.

SALARY

When you make out personnel forms in advance, there is generally a blank entitled "salary expected" or "minimum salary." Do not fill these out.

However, the embarrassing question of money has to be discussed. You must grasp the basic fact that your potential employer lives in a dreamworld when it comes to salaries. There may come a time when you will have to pretend to believe his dream. But whether you intend to worship or scoff, it behooves you to learn the score as soon as possible.

You may have noticed articles in engineering magazines from time to time gleefully explaining that job satisfaction of professional employes has been proved, in a recent survey, to be almost independent of pay. In the management type of magazine, the editorial slant differs only slightly. There they catalog all the "inducements" that are rated more important than pay. It is never really clear how the survey was made. But we, as potential members of a representative sample, know that the details of polling do not really matter. We weren't born yesterday. We know what they want to hear; and so did our colleagues who answered those questions.

The first article of management's salary faith is: No really worthwhile *professional* man ranks money first.

The second article of faith is usually phrased, "We pay the man, not the job." Now this statement is less than half true. The company has a top price it is willing to pay for the job to be done. However, it is flexible. It is willing to pay less. How much less depends on the man. It is rude, even foolhardy, to challenge a man's beliefs when they are rooted in necessity.

One of the favorite gambits of personnel interviewers and even of chief engineers is to ask you what you look for in a job. Answer as follows:

1) Challenging work, interesting work, etc.

2) Congenial companions, or anything else you can think of.

3) Money, expressed diffidently, like "And then there's salary, of course."

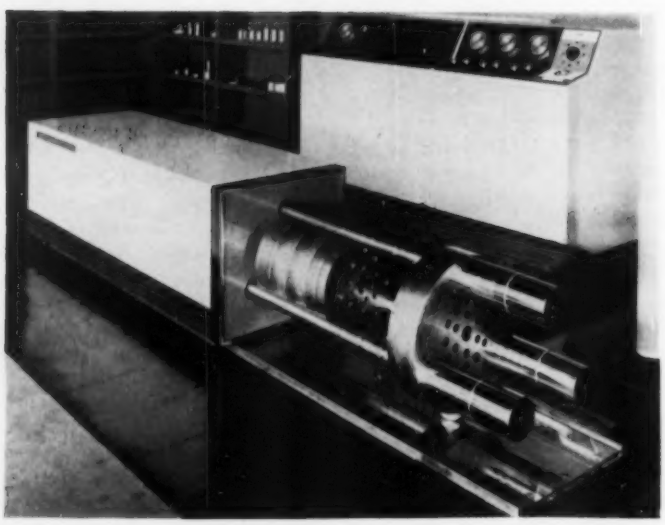
After you have been put through your paces, perhaps by a team who sweat you in shifts, your turn finally comes. But if you are not sharp, you'll miss it. Your interviewer asks you "what salary you require." In front of him is your resume with your last salary heading the list. *Don't panic!* Refuse to answer. Point out gently that it is not really a question of what you "require" so much as what you have been offered elsewhere. At this point you have broken contact with the salary he sees before him. He is on the defensive. He has no conceivable way of checking on any figure you care to mention. At this point, my friend you're on your own.

For REPRINT of above article, write E98 in space marked Special Data on one of the Reader Service cards bound in this issue.

TRENDS in appearance design . . .

Lighting and slightly softened contours **distinguish professional tape recorder, left, styled by Melvin Best Associates, Pasadena, for Ampex. Tape programming and control console, right, for machine tools displays direction and speed of tool travel graphically. Entire top raises for access to circuitry. By Emerson-Johnson-Mackay, Los Angeles, for Micropath, Inc., sub Topp Industries, Inc.**

Portable fault locator **and evaluator (left) for airborne fire control systems has data display, control positioning and connections recessed so that housing can protect against bumps. By Melvin Best Associates, Pasadena, for Aerojet-General Corp. Only those parts and areas where accessibility is essential are exposed in high energy rate forming machine and control console (below) designed by Zierhut-Vedder-Shimano, Los Angeles, for Convair.**



JACK MEYER, Los Angeles

■ It's generally agreed that the eleven Western states have developed distinct product-design preferences, based on similarities in taste, thought, way of life. And most designers out here even go a step further—they say the preferences are also ahead of those elsewhere in the US.

These men point to defense industries, generally regarded as a bellwether for consumer design and production. A disproportionately large share of major contracts has gone to Western companies in this field—particularly those requiring heavy R & D programs. Whether these contracts followed leaders in science and engineering or the men followed the jobs west, much exciting work in advanced fields is being done along the Pacific.

Hal Zierhut, of Zierhut-Vedder-Shimano, Los Angeles, says, "My partners and I have all worked for Eastern firms, although we are native Westerners. The approach is definitely more conservative back there. Our clients here will let us explore color and form and often buy a design the East would consider too radical. In fact, we have to be careful when we design a product for national distribution —we may get ahead of national taste."

The people in the Melvin Best Associates office, Pasadena, pride themselves on their ability to work closely with engineers in developing a product, rather than merely packaging it after engineering is completed. "If the industrial designer can't get along with the customer's engineers, he'd better find another trade."

Another industrial design firm suggests, "The weaknesses of western design often stem from the manufacturer, who is likely to be small or an appendage of an eastern firm. Many companies are still family directed, and have not yet recognized the need for industrial design."

EAST is EAST . . . WEST is WEST

A factor that cannot be overlooked is the apparently greater willingness of the consumer in this area to take a chance on radically new product. Like designer and manufacturer, the Western consumer seems less hampered by habit and tradition—for example, most of the advanced trends in architecture first won acceptance on the Pacific coast. There is little doubt that Southern California anticipated the revolt against oversized, overchromed, over-priced cars. Both sports cars and economy sedans were eagerly adopted while Easterners still joked about "those funny little foreign cars."

For products such as radios, television and high-fidelity equipment, Western design borrows freely from anything that has the modern look. One designer claims the East is still under the influence of European design.

Western designers feel that their approach has been sharpened by participation with engineers in evolving data-display systems and controls that will instinctively be used properly by persons under maximum stress, such as pilots under heavy G-loads. Information developed in this way has been applied by western designers to products ranging from kitchen ranges to oil-well drilling equipment.

There is another important, perhaps even unique, factor in the design situation. A Western characteristic is the relative ease with which an employee who evolves a product of his own can go into business. He finds plenty of rental space; there seem to be people ready to extend credit; trade associations in the area are most cooperative; there are many job shops ready to subcontract fabrication. Result: the West is constantly producing new ideas and products, a fertile ground for the industrial designer ■

Plywood-enclosed **combination refrigerator-electric-range-sink looks enough like a cabinet when closed to fit into living room - bedroom apartments. Styled by Lewis & Tweedie, Pasadena, for General Air Conditioning Corp.**

Industrial designers **helped oil-well drilling-machinery engineering staffs to (1) improve balance, (2) eliminate sharp edges and protrusions that might catch on or damage other equipment, (3) contour safety latches into main castings so that they could not accidentally be opened, (4) shape and locate handles (bottom photo) for single motion closure. 500-ton hook and elevator-spider, top, by Lewis & Tweedie for Byron Jackson Div, Borg-Warner Corp; elevator latch, bottom, by Merendino-Greene and Associates, Inc, Pasadena, for Web Wilson Oil Tools, Inc.**

Drum, cab and frame **of concrete mixer (with separable chassis) reflects latest construction-machinery design. Made by Cook Bros, Glendale**

High Legibility **and utmost simplicity are incorporated in wall thermostat by Lewis & Tweedie, Pasadena, for D H McCorkle Co**

POINTS OF

THE QUESTION: *"How Effective Are Committees In Product Planning?"*

WILLIAM M SCHMIDT
president
William M Schmidt Assoc Inc

"Without a product planning committee . . .

Thomas A Edison conceived products to light cities and bring music into the home. This was not without planning, however; thinking ahead has long been recognized as essential to individual success and progress. Today's growth and complexity of industry forces us to rely more and more upon group thinking, even in the product-planning stage. This is usually in the form of a committee represented by specialists in the fields of manufacturing, finance, engineering, sales and design with management as chairman.

"How successfully does this group replace the Edisons? In part, this depends upon the abilities of the individual specialists and the groups they represent, but primarily upon the way they function collectively. There are many pitfalls in committee thinking. Tendencies to stampede or stagnate must be moderated by good strong leadership. Majority rule, although democratic, all too often results in a middle-of-the-road approach—not necessarily the safest place to travel.

"Great strides in industrial progress have been made by firm management decisions, based upon accurate analysis but guided by strong intuitive reasoning. A committee can surpass an individual in analysis, but rarely shares a common instinct. This judgment must be supplied by management. In gathering accurate information, product-planning committees are absolutely necessary. But, in my opinion, they are worthless without a strong, confident executive to transform this into sound product determination. Only with this kind of direction can a committee plan a product effectively."

"The key to this question . . .

is in the word 'planning.' In this stage of product development, committee discussion is extremely effective, and most important. It is a rare individual who possesses all the knowledge necessary to thoroughly plan a new product from its inception as an idea through its sale as a finished product.

"In a committee session, the knowledge and experience of the engineering, research and development, economic, patent and marketing people can all be brought to bear on planning the entire development of the product. Once this is done, however, the committee chairman, who should be one of the highest level company officers, must delegate the responsibility and authority for carrying out the actual work. There is a time both for 'brainstorming' in committee, and a time for shirtsleeves work of an individual. The planning of a new product is when the committee is most effective."

J D RUSSELL
vice-president, engineering
Joy Manufacturing Co

SHERWOOD H EGBERT
executive vice-president
McCulloch Corp

"We maintain a close control over products...

through a Product-Planning Committee. This committee is composed of one member each from engineering, advanced development, sales and the executive staff. The chairmanship of the committee is held by the sales division member. The committee is basically responsible for recommending to the executive staff a continuous program not only for our present lines, but also for new expanded lines. The committee is kept small so that it can operate effectively but it does assign specific tasks to other people in various departments where detailed or specialized knowledge is needed.

"The effectiveness of this system of product design and control is dependent upon two important elements. First, the members on the committee must be of high caliber willing to devote themselves to the responsibility and capable of weighing all the facts in making their recommendations. Secondly, top management must not abandon its primary responsibility for basic leadership in control of products, but should expect the committee to weigh all the facts and make a recommendation on all product decisions.

"The chain of events from screening ideas (the world is full of them), to seeing an opportunity, to developing a product to fill the need, to marketing the product at a profit is checkered with pitfalls. We find the Product-Planning Committee the most effective way to help management reduce the hazards and minimize the failures."

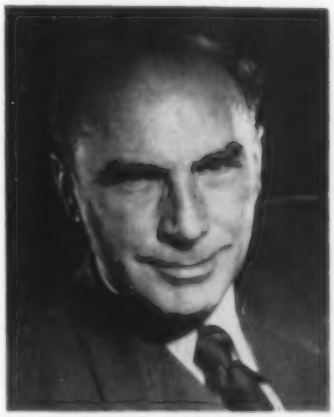
"Committee action is certainly necessary . . .

and can be most effective in the early stages of product planning, since management must know approximate manufacturing costs, sales possibilities and the competitive picture, to arrive at a profit potential. Experts in their respective fields, acting as a committee, can and should supply this vital information.

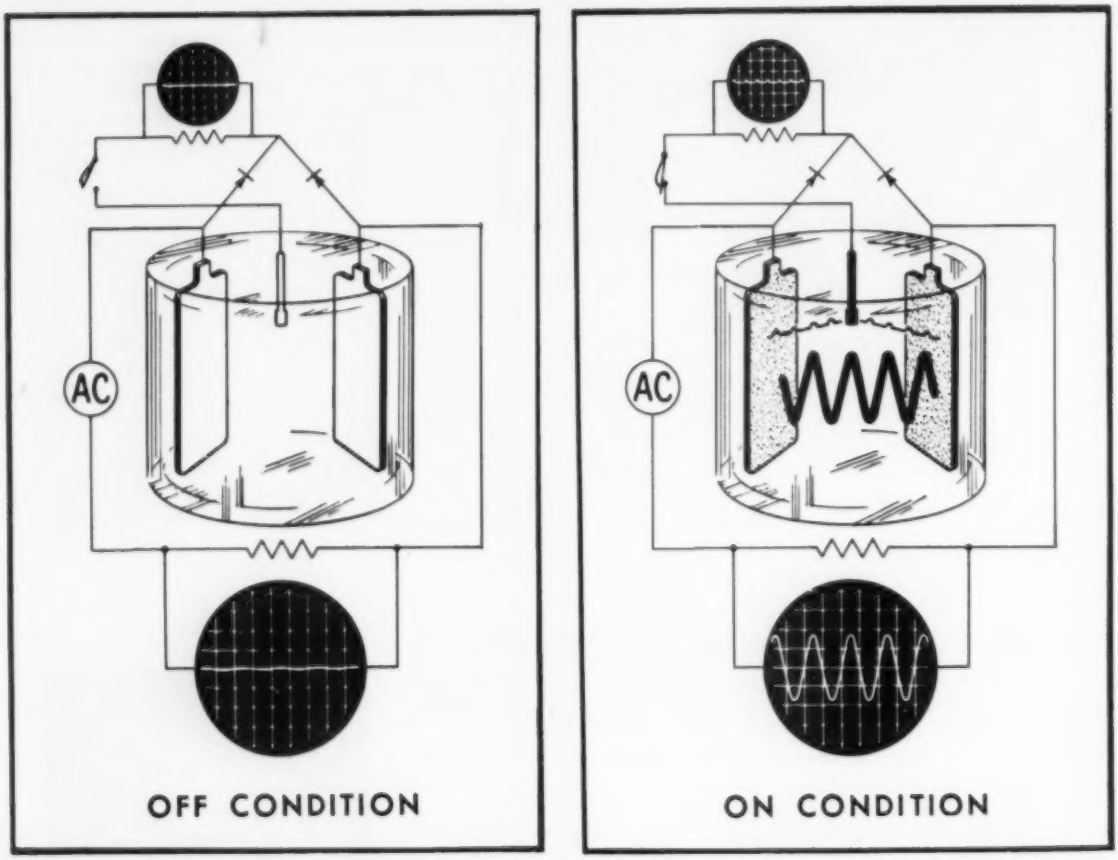
"But beware! The best product proposals can be over-discussed, and therefore diluted by too many experts with a finger in the pie. In our company, we begin with a screening committee to review product ideas submitted either to meet customer requirements in the field, or presented as the result of our own creative engineering. Ideas from the field may be preconditioned by the customer's needs. In the latter category the idea is often generated from a product line already in existence.

"From a committee standpoint, creative research, development or product testing suggests new directions for new applications of existing knowledge. More than likely, with a little modification here and there it will fit other applications. Herein lies the danger of too many 'cooks' diluting the initial idea or design. We try to give our project engineers complete authority after the initial approval of the management committee. We want them to be responsible for producing an item which can be sold at a profit, through sound engineering and simplified design.

"Our formula begins with an idea which is screened and approved in committee, then followed through by individual action—one man having full responsibility through development, preproduction testing and prototype production."



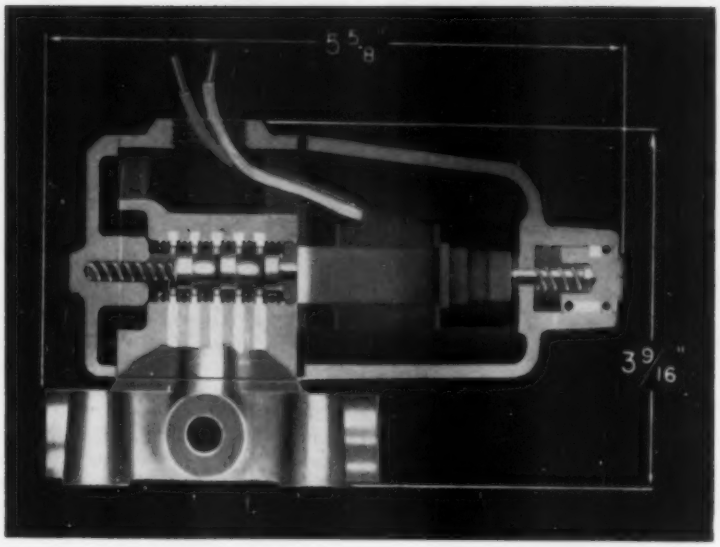
W R RAMSAUR
vice-president, engineering
The Garrett Corp



Electro-ionic device switches full ac sine wave . . . and consists of an acidic electrolyte conductor with two tantalum oxide terminals controlled by a smaller third electrode or grid of platinum. Electrolyte is used only as a conductor and switching action results from surface action on two tantalum electrodes. Small dc control voltage impressed on grid makes surfaces of these electrodes conductive within milliseconds. For power applications measured in watts, will be smaller than other static units. Will also switch dc, but not very well.

Performs more reliably than most mechanical relays because it has no moving parts, but a relay can switch more power in less space—at least at present state of development. The switch fails safe. Overload may cause surface action on electrodes to break down, but there is a few minutes delay before circuit opens completely. Electrode surfaces are self-healing and if overload is not severe and doesn't persist switch will be ready for full load again in a few cycles.

Only model currently in production will switch currents from milliamps up to 15 amp. Min potential is 3 v and max is 70. A miniature standard unit has also been built and measures about 1 x ½ in. dia, but is not in production. Ratio of control to load current can be varied from 10:1 to 50:1 or even higher, depending on requirements. Can be used as power amplifier because output can be modified. Most likely applications are at 60 cps. Response is ¾ cycle on, 3 cycles off. Virtually unaffected by vibration or magnetic fields and shelf life is measured in years. Temperatures of −35 F to 155 F are recommended, but wider range is possible. Delivery about 1 month for approved applications. **Ovitron Corp, 14830 Schaefer Highway, Detroit 27. Circle 101, Reader Service Card**



Four-way solenoid air valves . . .
measure only 3⅞ x 5⅛ in. and are recommended for vacuum or pressure to 300 psi. Capable of speeds up to 450 operations per minute continuous duty and intermittent duty up to 600 operations per minute. Will operate cylinders up to 4 in. bore. Response averages about 11 millisec on 60 cps ac. Inrush current is 0.85 amp and holding current 0.23 amp on 115 v, 60 cps. Solenoids are self-contained capsules that are easily serviced or replaced. From stock. Priced from $39.50 to $44.50 for single unit; $55 to $61.50 for double unit. Manifolding costs about $7.50 per station. **Numatics Inc, Highland, Mich.**

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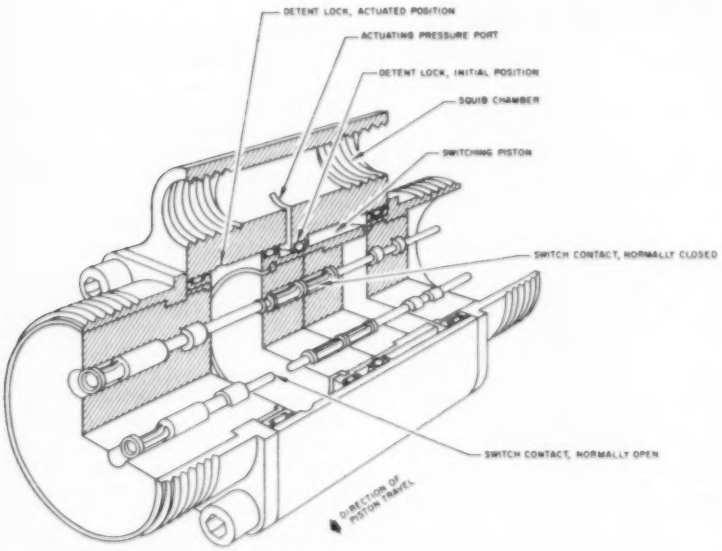

Pressure-actuated multicontact switch . . .
uses sliding piston with feed-through socket contacts to open and/or close up to 100 circuits in 10 millisec or less. Can be actuated by 300-500 psi pneumatic circuit, explosive squib or other means. Any sequence of opening and closing contacts can be carried out by extending piston's pin contacts to various lengths, so that piston will reach various points of contact at different times as it rides over them. Fabricated to customer order in 8 to 10 wk. **Cannon Electric Co, P O Box 3765, Terminal Annex, Los Angeles 54.**

Circle 103, Reader Service Card

Spray-on vinyl coating . . .
for metals, wood, fiber, paperboard and other materials will retain the detail of patterns such as those in textured steel. Process, which is electrostatic, can also be used to provide continuous finish over assembled or welded products. Has a dielectric strength of 750 v and is available in a range of standard or matched colors. Manufacturer will coat parts on contract basis or will license users to apply materials and process in own plant. Material and process is said to average up to 30% saving over other products and methods. **Kaybar Inc, Birmingham, Mich.**

Circle 104, Reader Service Card

Solid-state switch . . .
capable of operating at a speed of 0.001 sec, has no moving parts, weighs 9 oz and measures 2 x 1¼ x 3 in. Consisting of toroidally wound magnetic cores and silicon rectifiers encapsulated in an epoxy compound, device is said to be capable of remembering to open and close circuits, not close circuits, delay closing, or close circuits when external conditions require it. Switch has two control windings, bias and feedback. Application of 1 ma of power from a 5 v control source permits switching loads up to 20 w. Replaces electro-mechanical relays in complex control systems. **Magnetic Amplifiers Inc, 632 Tinton Ave, New York 55.**

Circle 105, Reader Service Card

Pure molybdenum sheet . . .
is said to bend 90 to 180° at room temperature (at sizes where ordinary sheet will cations, 3 to 6 wk max. No increase over commercial grades to delaminate on punching, stamping and shearing. Properties are most significant in thicknesses ranging from 0.0025 to 0.125 in. Normal delivery as commercial quantities, to be available about Aug 1, to customer specifications, 3 to 6 wk max. No increase over present prices for as-rolled molybdenum sheet. **General Electric Co, Nela Park, Cleveland 12.**

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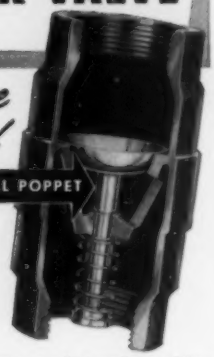

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EMPLOYMENT OPPORTUNITIES

OPPORTUNITIES . . .

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Growth Company

A progressive, rapidly expanding manufacturer in the field of xerography—a method of physical photography based on solid state and electro-static phenomena—has an opening for:

PRODUCT ENGINEER

M.E., E.E., or I.E. with 3 to 5 years experience in design of electromechanical machines and equipment for manufacture.

Familiarity with tooling helpful.

Kindly send resume and salary requirements to:

FRED A. WETERRINGS
Industrial Relations Division

HALOID XEROX INC.
2-20 Haloid Street
ROCHESTER 3, NEW YORK

OPPORTUNITIES . . .

With
A
Growth Company

A progressive, rapidly expanding manufacturer in the field of xerography—a method of physical photography based on solid state and electro-static phenomena—has an opening for:

MANUFACTURING STANDARDS PLANNER

Technical school graduate or M.E. with minimum of 5 years experience including several years in area of preparing standards and developing procedures and systems. Familiarity with manufacturing methods is essential. Must be able to express self clearly and accurately.

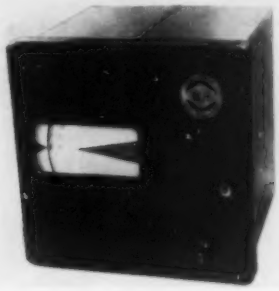
Duties will include: preparing general manufacturing engineering standards for the approval of departmental and divisional supervision; working in conjunction with Tool and Gauge Planners for standardization of tools and tool components; reviewing engineering standards for compatibility with manufacturing engineering standards, and suggesting revisions and modifications as necessary; developing and recommending procedures or systems for internal control purposes in Production Engineering Department. This individual will function as Production Engineering staff representative in consultation with Materials Engineering and Production Control in establishing divisional standards, evaluating the accomplishments of these objectives, and modifying or revising as required within the limits of their scope and performing.

Kindly send resume and salary requirements to

FRED A. WETERRINGS
Industrial Relations Division

HALOID XEROX INC.
2-20 Haloid Street
ROCHESTER 3, NEW YORK

SIGNIFICANT COMPONENTS MATERIALS PROCESSES . . .



Disk indicator . . .

is used with measuring and control systems employing resistance strain-gage transducers, such as weight and load measuring systems, pressure systems, torque and hp measuring systems. Medium-sized instrument is said to offer accuracy of 0.15% of full scale, but to require less than 1 sq ft of panel area for mounting. Horizontal readout window and up to 500 engraved dial graduations are features of automatic, null-balance type unit, which uses servo-driven slide wire to balance internal bridge circuit. Available in 13 models. **Electronics & Instrumentation Div, Baldwin-Lima-Hamilton Corp, Waltham, Mass.**

Circle 107, Reader Service Card

Explosionproof rheostats . . .

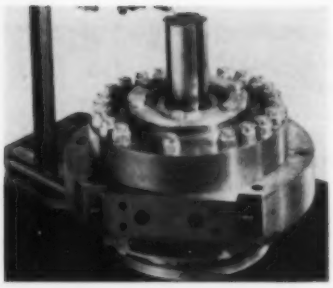
are metal-cased modifications of 25 and 50-w encased power rheostats and meet requirements of MIL-E-5272A. Independent testing laboratory is reported to have filled modified units with butane gas and placed them in chamber filled with more gas. Gas within rheostat casing was ignited and resulting explosion is said to have been fully contained within encased units. **Clarostat Mfg Co Inc, Dover, NH.**

Circle 108, Reader Service Card

Acceleration switch . . .

for control or limiting applications on acceleration changes in two directions is responsive to axial acceleration, single and bidirectionally, from 5 to 50 g. Actuating time is 20 millisec, with accuracy said to be within 5%. Designed with only one moving part, a ground ball held by uniform magnetic field. Ball is released to close or open electric circuit when force of acceleration exceeds magnetic force. Switch is factory preset, with nominal setting specified by user. It can be adjusted, if desired. Service life is said to be 100,000 cycles. **Inertia Switch Inc, 311 W 43rd St, New York 36.**

Circle 109, Reader Service Card



Hydraulic actuator . . . (Model 30-87-120) is 8 x 8½ in. wide and has dry weight of 36 lb. Stall torque at 3000 psi is 8700 in.-lb. Internal leakage is 0.20 gpm. There is no internal snubbing in this model. Stall torque of Model 30-100-90S is 10,000 in.-lb at 3000 psi. Measures 7¾ x 8⅛ in., has dry weight of 50 lb, internal snubbing of 15° and 0.25 gpm internal leakage. Model 30-190-120 is 10⅜ x 10 in. and has dry weight of 80 lb. Stall torque at 3000 psi is 19,000 in.-lb with no internal snubbing. Internal leakage is rated 0.30 gpm. Frequency response is 0 to 200 cps for all models. **Vard Inc, 2981 E Colorado St, Pasadena, Calif.**

Circle 110, Reader Service Card

Digital step motor . . . and solid-state control offers bidirectional controlled step output for input signals up to 3 kc, high instantaneous response rates, high step resolution and linear response. Self-locking, stable, non-oscillating motors are said to provide excellent torque-to-speed characteristics with outputs ranging from 1 in.-oz for instrument-size motors to 100 in.-lb for large industrial unit and with steps per revolution from 36 to 108. Rated for continuous, intermittent or stalled operation through a 24 to 250-v dc range. **Teller Co, PO Box 989, Butler, Penna.**

Circle 111, Reader Service Card

Hydro-expanded pulleys . . . said to increase conveyor belt life are formed by application of pressures up to 4000 psi to arc-welded steel cylinders. By expanding cylinder into retaining die, metal is cold-worked with crown faces tapering ⅛ in. per ft, from ends of pulley to center of face. Hydro-forming expansion equipment produces pulleys in face widths of 12 to 66 in. Cold-working of metal to form crown is reported to change molecular pattern and to increase strength 25%. Belt conveyor pulleys are concentric to within 0.030 in. total indicator run-out. Pulley crown is formed on true center, aiding initial belt setting and helping to keep belt continuously centered. Pulleys are also said to be free from crown welds. **Link-Belt Co, Dept PR, Prudential Plaza, Chicago 1.**

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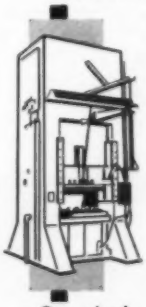
Chace THERMOSTATIC BIMETAL

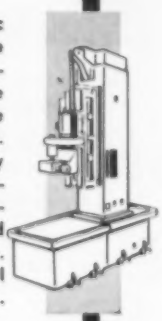
ACTUATES ANOTHER PRECISION PRODUCT...

THE Westinghouse MARK 75 Circuit Breaker

A product of Westinghouse Electric Corp., Beaver, Pa.



Westinghouse Electric Corporation has an answer to the high cost of network circuit protective devices. Their new Mark 75 line of *molded case* circuit breakers, available at a fraction of the cost of other high interrupting capacity breakers, can be used on high power applications up to 75,000 amp capacity (240V a-c). This extremely high interrupting capacity breaker uses no fuses or reactors. It is available in four frames (HF, HK, HKL, HLM) identical in size, and interchangeable with the standard line of Westinghouse AB Breakers. The actuating element, of course, is Chace Thermostatic Bimetal.



Our single product, as you may know, is thermostatic bimetal. In the third of a century during which we have concentrated all our development, engineering and production skills on the perfecting and manufacturing of one product, we have evolved a series of processes which we feel are as close to faultless as exist in the industry today. Our alloys and bimetal combinations are backed by literally years of testing and actual service before they are announced to the critical buyers of such products. Chace equipment is the finest available and it is constantly checked and improved to keep abreast of production developments. That's why people like Westinghouse specify the bimetal that never lets them down — why "You Can Be SURE . . . if it's Westinghouse."

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Thermostatic Bimetal
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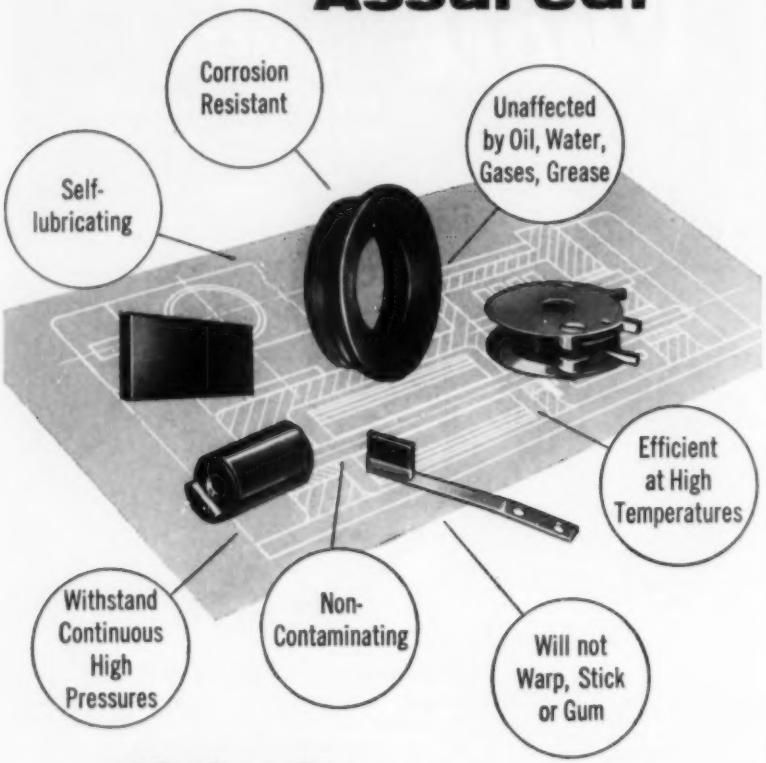

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Morganite has the answer to countless hard-to-solve design considerations. Its many inherent electro-mechanical advantages afford engineers extremely wide latitude and a high degree of flexibility. For example, self-lubricating Morganite bearings are ideal for incorporation in sealed mechanisms. Radar contacts of Morganite are employed in critical military and commercial systems because of exceptional dependability over a wide range of temperatures. For suggestions on your design problems, just call or write, Morganite!

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of pushbutton, snap-action type are housed in anodized aluminum cases for use where space and weight are critical factors. Mount by $\frac{1}{4}$-40 threaded bushing. Switches, $\frac{13}{32}$ in. dia and $\frac{9}{16}$ in. long, handle 2 amp at 28 v dc or 120 v ac with life of 25,000 operations min. Plunger cap color is optional. **Hetherington Inc, 1420 Delmar Dr, Folcroft, Penna.**

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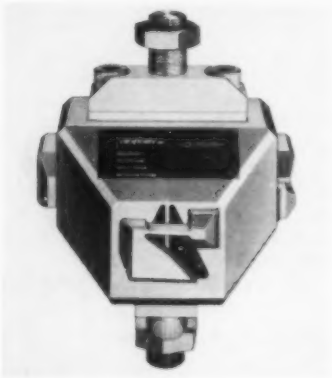


Small flexure pivots . . .

said to eliminate friction, slop, looseness and wear are for use in high-precision calibration, weighing and quality measuring systems. Supplied as universal, two- or single-direction pivots. Design couples max axial stiffness with min rotational restraint. In single and bidirectional structures, integral metal block is machined to define upper and lower securing surfaces, with central load-carrying flexure web extending between two surfaces. Blocks can be used singly, or properly oriented, in pairs for two-directional flexure; or combined to handle larger loads. Size is 1.45 cu in. Supplied from stock in load capacities of 0 to 1,500,000 lb. **Aersoscience Inc, 3155 N Rosemead Blvd, Rosemead, Calif.**

Circle 114, Reader Service Card

X-Y plotter . . .

switches scales by pushbutton, with vernier control permitting scale expansion to next setting. This permits operator to expand between scale voltages to fill entire plot area. Static accuracy of $\pm 0.1\%$ of full scale is claimed; dynamic accuracy is $\pm 0.2\%$ at 10 ips tracing speed. Separate switching circuit for X and Y references permits translation of these origins to any position in plot area. **Librascope Inc, Glendale, Calif.**

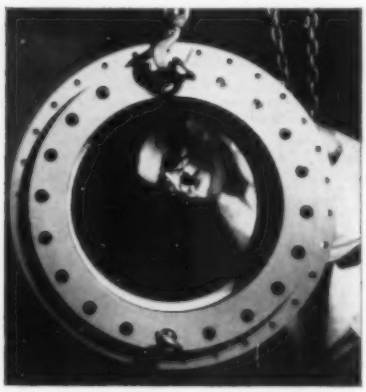
Circle 115, Reader Service Card

THIS IS GLASS

A BULLETIN OF PRACTICAL NEW IDEAS FROM CORNING

NEW PICTURE WINDOWS FOR NAVY'S NUCLEAR REACTORS

In the "older" models of the Navy's nuclear subs, a periscope was used for checking reactor operation.



Not so in today's subs. Now you'll find giant peepholes—windows that let you look directly into nuclear compartments.

These windows are made from a combination of Corning high-lead-content glass and a plastic. The latter shields against neutron bombardment. The high density *glass* (6.2 cc, the equal of iron for shielding) protects against gamma rays.

Just for the record, seagoing radiation windows are only one part of a rather extensive line that Corning makes.

To date, for example, we've handled the shielding window problems of some 200 "hot" cells. Such windows often approach Gargantuan proportions . . . like the five-foot-thick, nine-ton job we finished recently.

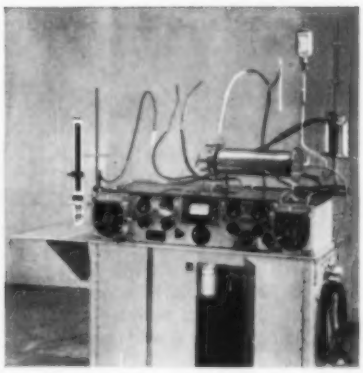
The big advantage for you, the user, in all this . . . aside from the fact that you can get any combination of three very special glasses we make for shielding . . . is *simplicity*. You just tell us your energy level, wall thickness, and the viewing area you need. We do the rest . . . ship you a window that's *ready to install*. It's as easy as that.

Added incentive: The most recent design change we've come up with involves a more pronounced *taper* than was previously used. This makes for less weight, easier installation, better fit.

Delve further into this subject by checking the box in the coupon, labeled "Radiation Shielding Windows." This will bring you a detailed booklet. Or drop a note outlining what's on your mind to Plant Equipment Sales Department.

THE HEART OF THE MATTER

During certain operations involving the heart, both the heart and lungs are given a rest.



But the functions of these organs still must go on. So ingenious machines take over. Like the Kay-Cross rotating disc oxygenator that does the work of the lungs, controlling the CO_2 and putting in pure oxygen.

The main component of this oxygenator is a series of discs, so designed that blood spreads out without foaming or bubbling.

Comes the commercial. These metal discs must be enclosed in a container. And the people who make the oxygenator, Pemco, Inc., chose a PYREX brand glass to hold the discs.

For good reasons. First off, this PYREX brand glass lets you keep careful watch over the *color* and *flow* of the blood, both very vital considerations to the medical men who use this machine.

Then, this PYREX brand glass is *inert* chemically. It does not add to or take from the blood in any way. There is no pickup, no side effects.

And, because this glass has a low coefficient of thermal expansion, 32 x 10^{-7}in/in/°C., the entire machine can be steam sterilized *without* any fear of danger from thermal shock.

While this particular application may be far afield from your work, one of the PYREX brand glasses may still turn out to be the answer to one of the tough design problems you are now facing.

You'll find that this transparent, corrosion- and thermal-shock-resistant glass is available in rod, tubing and flat glass. And it can be worked into a wide variety of special shapes by automatic pressing and blowing machinery.

Perhaps the best approach for you is to avail yourself of two well-detailed reference folders, B-83, "Properties of Selected Commercial Glasses," and IZ-1, "Designing with Glass for Industrial, Commercial and Consumer Applications." Use the coupon.

YOU CAN MAKE GLASS BREAK THE WAY YOU WANT WHEN YOU WANT

Tempered glass breaks in a very special way—we call it "dicing"—and that has led to some very special uses:

Rupture discs—Say you're holding a liquid or a gas in a container and at some precise moment you want to release it suddenly and smoothly. You can insert a tempered glass disc in your container, a disc that has been prepared to disintegrate at a given pressure.

The pressure can be applied by the fluid or by a small charge attached to the disc. When you want it to go, the glass will shatter instantaneously and homogeneously into small pieces.

Probable uses for this include safety valves on process equipment and as a substitute for intricate valving on fuel injection systems. Using PYREX brand Glass No. 7740, you can cross corrosion off as an inhibiting factor on valves. Pressure ranges run from 100 to 1000 psi.

Metal samples and billiard balls—Glass is also being used in the form of tubes to remove samples from molten metals . . . the glass crazes but holds together long enough for your sample to cool into a smooth cast; then you strip off the glass and you're ready for analysis. The plastics people are using glass molds where they want smooth surfaces . . . billiard balls, for example; when the plastic cools you just chip away the glass.

Want glass that breaks how and when you want it? Write to our Industrial Components Sales Department, spelling out your problem.

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NEW LITERATURE

Risk and Technological Innovation

W PAUL STRASSMAN, Michigan State University. Cornell University Press, 124 Roberts Place, Ithaca, NY. 249 pp, 6¼ x 9¼. $4.

Well-written history always makes good reading, and when it is devoted to explaining how technological innovations affected the development of some of the principal American industries, you have a book of absorbing interest to present-day engineers, so many of whom are working again today in an atmosphere of exploration and discovery. And since this book also discusses how the achievements of engineers, scientists and inventors are affected, in turn, by such entrepreneurial considerations as investment risk, a broader understanding of the functioning of our industrial society is likely to be obtained.

Strassman makes a sharp differentiation between innovation and invention in his opening chapter, devoted to definitions. He points out that the latter frequently is merely a further refinement of the original innovating development. Similarly, risk is established as only associated with the initial exploitative undertaking around a new product, service or process—not with competitive undertakings that follow successful initiators into a new, already proved field. Most of the rest of the book is then taken up with histories of some major industries.

In his conclusion, Strassman analyzes the principal types of entrepreneurial risks. Characteristic of his refreshing approach is the following, taken from his closing paragraphs, ". . . technological innovations in manufacturing methods had been reduced to a fairly predictable and safe routine before the advent of giant corporations and their laboratories. A close look at history should therefore correct anyone's impression that technological innovations actually attempted in manufacturing methods were generally risky . . ." —JK

Soviet Physics–Uspekhi

The first issue of an English language version of the leading USSR physics journal, Uspekhi Fizicheskikh Nauk, has been issued. There will be six issues a year, each containing two consecutive monthly issues of the Russian original. Publisher is the American Institute of Physics, 335 E 45th St, New York 17, and the cost of a subscription is $45 per year, with special discounts to libraries.

TITANIUM FASTENERS—Catalog, 12 pp. Reviews titanium fasteners, special products and special facilities for handling titanium. Basic engineering section reviews general properties and advantages of titanium. Performance data includes table of comparative mechanical properties for steel and titanium bolts. Plots of comparative fatigue strengths for tension and shear bolts of the two metals are also shown. Standard Pressed Steel Co, Dept 545, Jenkintown, Penna.

Circle 121, Reader Service Card

FABRICATING PROTOTYPE PARTS—Brochure, 4 pp. Describes how method can fit into design program, materials that can be used, case histories and tells in detail how to use service. Minnesota Rubber Co, 3630 Wooddale Ave, Minneapolis 16.

Circle 122, Reader Service Card

FLEXIBLE SHAFTING—Brochure, 8 pp. Covers applications, selection and specifications of flexible shafting. Sample of power drive and remote control flexible shafting, together with sample of casing material is available with brochure. F W Stewart Corp, 4311-13 Ravenswood Ave, Chicago 13.

Circle 123, Reader Service Card

ENGINEERING AND PRODUCTION FACILITIES—Booklet, 16 pp. Discusses facilities for design and manufacture of components for systems, including aircraft instruments, frequency standards, potentiometers, test equipment for automation and plastics. Typical products are illustrated. Borg Equipment Div, Amphenol-Borg Electronics Corp, Janesville, Wis.

Circle 124, Reader Service Card

VINYL ON METAL—Bulletin, 8 pp. Covers features, advantages, performance information, forming and fabrication methods and typical applications. Clad-Rex Corp, 2101 Indiana Ave, Chicago 16.

Circle 125, Reader Service Card

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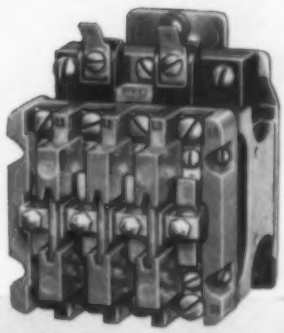

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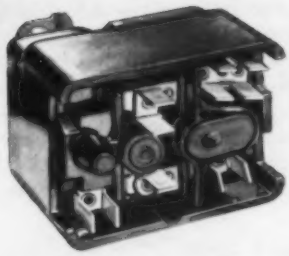

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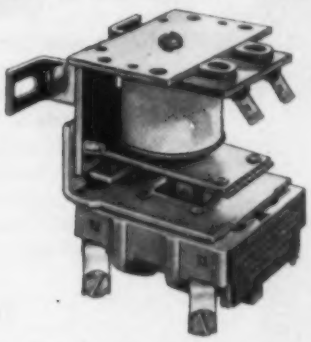

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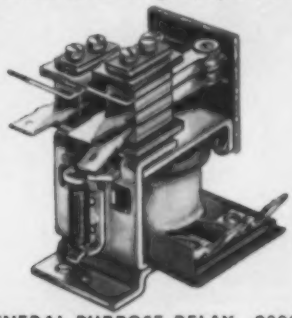

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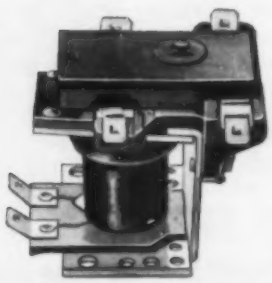
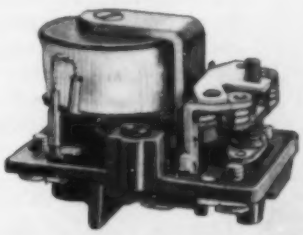
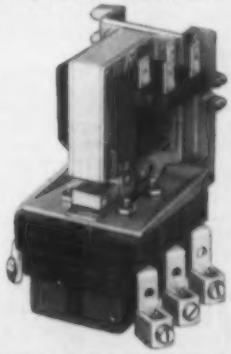


TYPE 75 Low cost power relay. Dependably handles up to 6000 W. at 240 V., resistive load per pole. Compressor rating 2 poles, 18 amp. running, 90 amp. locked rotor at 250 volts.



SERIES 129000 SHUNT TYPE RELAY—SPNO, SPNC or NO-NC For standard commercial voltages. Other coils available for special application. For heater, fan control, general circuit switching, etc.



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For Your Information (personal)

Playing with light

A light-polarizer kit that takes its cue from the old kaleidoscope—and presents, through a protractor tube, changing pictures that demonstrate polarizing principles and stress patterns—is offered by Science Materials Center, 59 Fourth Ave, New York 3. With the kit (priced at $2.25) comes a 28-page manual that does an extremely good job of explaining polarization in simple terms, and suggests experiments ranging from measurement of sugar concentrations to demonstrations of Malus' and Brewster's Laws. (The former is defined in the manual as stating that the intensity of light transmitted by two polarizers is given by the formula $H = \frac{1}{2}\cos^2\theta$, where H is transmittance of light, and θ is angle between axes of the polarizers. Brewster's Law says polarization by reflection is complete only when $\tan i = n$ (i angle of incidence, n index of refraction.)

Pointed Story

A lead pencil that's "strong as a hard pencil, but writes black as a soft pencil," makes carbon copies with ease, and reproduces well on photocopy machines is claimed by Venus Pen & Pencil Corp. A chemical miracle, the company calls it, "able to outwrite and outlast any other office pencil available anywhere." The secret? "A vastly improved clay and graphite structure formed through new methods of processing"—methods said to affect the heart or core of the lead and give it its usual stamina.

Now being introduced to the market, the pencil is priced at 10¢ for one; $7.20 per hundred.

More miracle menders

Another "miracle adhesive" is headed for market—this one from Chrysler Corp's Cycleweld Chemical Div. It marks the division's entry into the consumer field, and is obviously based on the division's well-known industrial products.

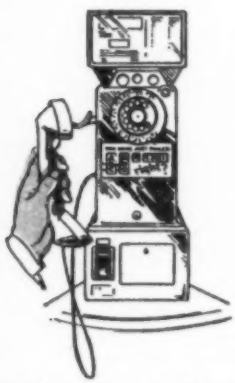
Cycleweld describes the material as "a putty-like synthetic plastic that sets up into a substance like iron a few hours after it is mixed with a clear liquid hardener."

Quite a "miracle" it seems to be. Says Cycleweld: "A *Liquid Iron* bond will retain its strength up to 300 F . . . is durable, nonshrinking and nonexpanding . . . and can be used to repair everything from a broken mast on a sailboat to a cracked engine block." Cure time, at room temperature, is about 18 hr, though the material will reach full strength considerably faster if heated to about 180 F.

Why Don't They Research and Develop . . .

. . . a touch-up paint for automobiles that can be artificially "aged" to match the old paint. In many cases, the touch-up paint, although nearly the same color as the original, is almost as unsightly as a scratch or nick because it has more luster and has not been oxidized or weather-worn. Ideally, touch-up paint would be sold with a bottle of ageing activator —a chemical which, when applied to the new paint, would cause rapid ageing and oxidation. When the spot matched the old paint, the activator would be neutralized or washed off. The activator, however, should not affect the original paint.—R Marie

. . . a sealant, similar to those used in auto radiators, for stopping small leaks in household water supply systems. Such leaks can be annoying and expensive to repair particularly in modern houses which have no basement. It is often necessary to tunnel back along the pipe to find the leak. The compound, which would harden on exposure to air at the point of leakage, should be supplied with the proper fittings for injecting it into the water system. It should also be non-toxic, tasteless and easy to flush out of the line. —J Meyer



. . . an indicator for pay telephones which would show the number which has just been dialed. This would help avoid wrong numbers and dialing errors that result from dialing zero for the letter O or forgetting the last digit dialed when interrupted in the middle of a number. The indicator could be simply a series of windows to show each digit as it is dialed, slot-machine fashion, and clear when the call is terminated. The first two windows would show groups of three letters (corresponding to the exchange) and the other windows would show only numbers. However, if a zero were dialed for either of the first two digits, it would appear instead of the letter groups.—A Esposito

. . . a central refrigeration system for homes that would replace air conditioner, refrigerator, and freezer. It could also be rigged to preheat the hot water supply. —R Preston

Have you a problem, based on known scientific principles, which seems to have an answer somewhere within the limits of present technology? To inspire inventors along worth-while paths, PRODUCT ENGINEERING invites you to trade such problems with fellow readers who may have a fresh viewpoint or more time for necessary R & D. We will pay $10 for each one accepted.

Publisher's Postscript...

Firefighters

"It takes all the running you can do to keep in the same place," said the Queen. "If you want to get somewhere else you must run at least twice as fast . . ."

It seems as if we spend most of our lives running to put out fires. No sooner is the screen door fixed than the faucet needs a new washer, the lawn needs reseeding, a window pane must be replaced. And companies are exactly the same, if not worse.

The fireman in most manufacturing companies is the engineer. You. But you're also the architect of change, the father of progress, and progress starts more fires than anything.

So here we are, 'round that mulberry bush again.

Publications are just like manufacturing companies, except that we have more customers than most. Every year nearly 2½ million issues go to engineers, designers, "architects of change" who have some definite ideas about what they want.

After more than 10 years of experimenting, we were finally able to deliver a binding that needs no metal side stitch. For several months now your Design issues have been bound with a special glue, permitting clean removal of articles, plus the ease of handling a "lie flat" magazine.

Progress? Sure, but, of course, this started another fire. So before we go running for the hose we'd like to be sure it's what you want.

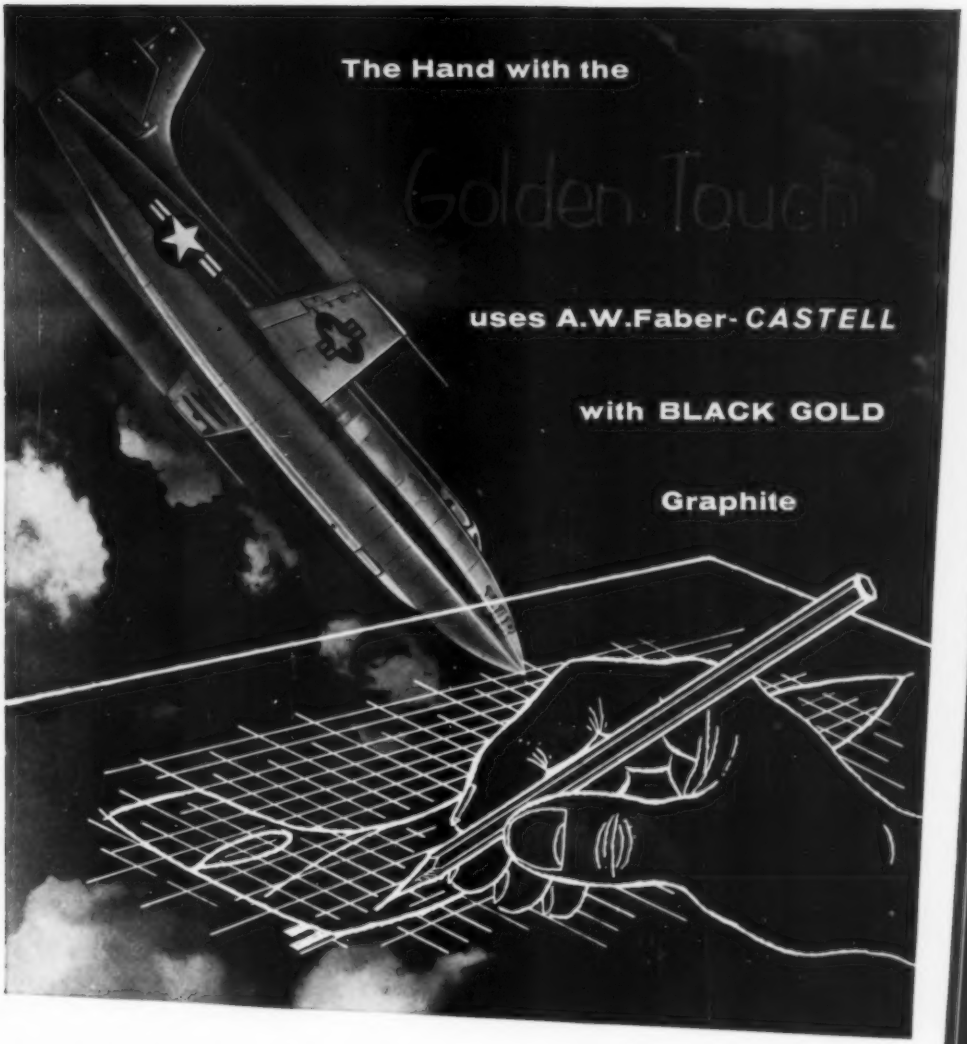
Readers like the easy tear-out characteristics of the new binding, "but", they say, "why stop halfway? Start all articles on a right-hand page and finish on the left so that removed articles don't destroy the rest of the issue."

There are a couple of ways this can be done—but, as usual, they are not without corollary problems.

For example, what about 3- and 5-page articles? If you stretch them to 4 or 6 pages you waste valuable editorial space. If you shrink them to 2 or 4 pages you cut out useful information.

We could separate the articles by inserting advertisements as necessary. But many readers prefer their feature-article section in a compact package.

What do you think? If you've got a preference, take a moment to write it out on the Reader Service card and send it in. Here's a blaze you can fan or douse as you see fit. —SJA



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